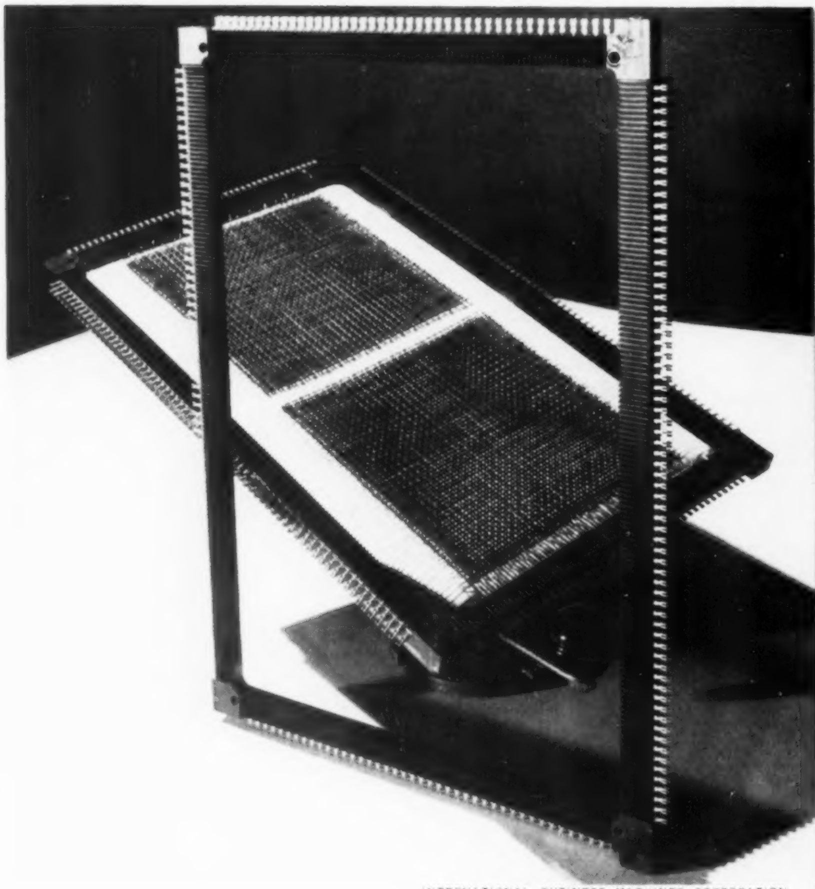
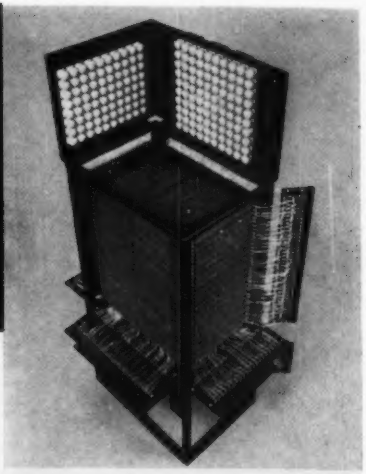
MODERN PLASTICS

FEBRUARY 1959



INTERNATIONAL BUSINESS MACHINES CORPORATION



MODERN ABACUS enables man to string words and numbers on wire like beads and pick them off again in millionths of a second. Durez phenolic is used to frame the thousands of ferrite cores in IBM magnetic data-storage unit. In an array of core planes stacked atop one another, electrical impulses alter the magnetic state of cores. A line of cores, some altered, some neutral, stands for a word or number, awaiting the impulse that releases it for calculation.

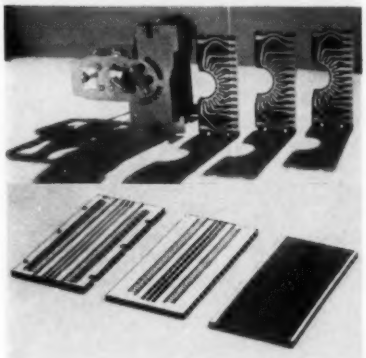
Material for a jet-age abacus

Engineers needed a non-warping material for the frame that supports thousands of tiny ferrite cores, heart of the magnetic "memory" in IBM data-processing systems.

Requirements were stiff. The frame must be an excellent insulator. It must be free of internal stress that would cause warping or cracking. During assembly it must withstand the blistering heat of dip soldering without losing its dimensions. Once assembled, it must not shrink or expand.

The material finally selected for this job is a Durez phenolic. Mineral-filled, it has a low molding shrinkage of 0.003 in./in. that minimizes stress and strain. Its water absorption is a low 0.2%. It stands temperature of 325°F under ASTM D648—easily survives the soldering operation. Its electrical properties, including arc resistance, meet every requirement.

This is only one more example of a host of jet-age assignments handled with the new Durez phenolics. You can do more—meet today's needs better than ever before—with this wide-ranging family of materials. Thermal stability, electrical properties, impact strengths are up; costs are attractively low. To get an idea of the new latitude Durez phenolics give you, write for illustrated Bulletin D400.



IN OTHER IBM EQUIPMENT Durez phenolics prove their inborn versatility. Molded circuits employ a Durez mineral-filled compound in stepping switches and emitter for card-feed unit of an accounting machine.

DUREZ®

HOOKER CHEMICALS PLASTICS

PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION

1202 Walck Road, North Tonawanda, N. Y.

For versatile beauty...
for supple strength... *Catalin* **POLYETHYLENE**

Sparking a responsive note from thrifty shoppers with an urge for self-expression and more imagination than money . . . "Decor-Weve" Flower Pot Holders by Nu-Dell* have hit the best-seller lists in gift and houseware departments everywhere.

Turned and twisted into fanciful shapes, they come through the ordeal handsomely because they are molded of flexible, sinewy, low-density CATALIN POLYETHYLENE.

As easily as the flexibility of "Decor-Weve" incites endless ideas in home decoration . . . so too can the wide range of low to high density CATALIN POLYETHYLENE formulations stimulate new, best-selling product ideas for designers and manufacturers.

From gymnastic bendability to outstanding rigidity, CATALIN POLYETHYLENE formulations span densities from .915 to .96, with melt indexes from 0.2 to 50. Within this broad spectrum, the specifications engineer can confidently select one to achieve the best possible results . . . whether by injection molding, blow molding or extrusion. Inquiries invited.

**Nu-Dell Plastics Corporation, 2250 North Pulaski Road, Chicago 39, Ill.*

Catalin Corporation of America Catalin **One Park Avenue, New York 16, N. Y.**

MODERN*

THE COVER

Handsomely styled housing, being installed on outboard motor, is molded of reinforced plastics in a plant of advanced design. The full story is told in our lead article "New mass-production plant for RP molding," p. 87. Color photo courtesy Outboard Marine Corp.

THE PLASTISCOPE

EDITORIAL

GENERAL SECTION

Modern Plastics issued monthly, except September when issued semi-monthly, by Breskin Publications, Inc. and Plastics Catalogue Corp., at Emmett St., Bristol, Conn. Second-class postage paid at Bristol, Conn. Subscription rates (including Modern Plastics Encyclopedia Issue), payable in U. S. currency: In United States, its possessions, and Canada 1 year $7, 2 years $12, 3 years $17; all other countries, 1 year $25, 2 years $45, 3 years $60. Single copies 75¢ each (Show issue, $1.00; Encyclopedia issue, $3.00) in the U. S., its possessions, and Canada; all other countries $2.50 (Show issue, $3.00; Encyclopedia issue $6.00). *Reg. U.S. Pat. Off

PLASTICS*

FEBRUARY 1959
Volume 36 Number 6

Coming up

Our March issue will feature the first of a series of three articles exhaustively covering the urethanes. Also in March the inside story on a fully automated and integrated plant for extruding styrene alloy sheet and forming it into refrigerator door liners at a fantastic rate of production . . Engineering section will feature the first in a series of articles on problems in premix molding and how to solve them . . . April lead is about new methods of decorating molded plastics.

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N.Y.
Please mail all correspondence change of address notices, subscription orders, etc., to above address.

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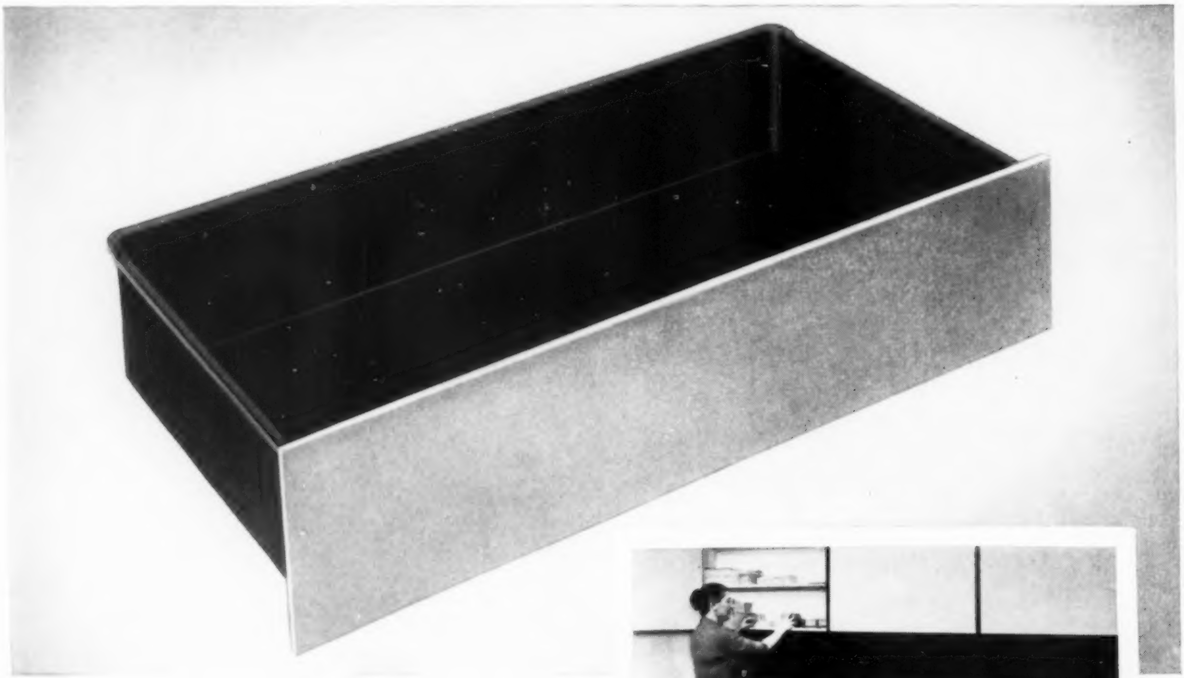
A new dimension in functional beauty for customized storage areas



One-piece compression molded plastic drawers

—produced for KNOLL-DRAKE by Chicago Molded

To improve the lasting beauty and complete utility of their products, furniture manufacturers are taking advantage of the versatile medium of molded plastics. Knoll-Drake Products Inc., with sales offices in Austin, Texas, visualized a highly functional set of phenolic plastic drawers in various sizes up to $34\frac{3}{8}$" x $18\frac{3}{16}$" x $7\frac{3}{16}$". The range of sizes allowed for a flexibility of furniture cabinet design which could combine two or more of the drawers.

Major considerations were inexpensive installation, dimensional stability, ease of maintenance. Could the drawers be efficiently compression molded in one piece and maintain, in cooling, the specified tolerances?

Chicago Molded had the production facilities, and the know-how to do the job that resulted in achieving and maintaining the specified tolerances. "Time, labor and material savings in molded plastic drawers can be passed on to the consumer . . . making a more saleable product", according to W. F. Drake, Jr., President of Knoll-Drake.

If large molded plastic parts figure in your future product design, the know-how and complete production facilities of Chicago Molded are geared to do an equally fine job for *you* . . . in a way and at a price that will most likely give you a better end-product at lower cost. But that's just part of the story. We mold all materials—thermosetting and thermoplastic.

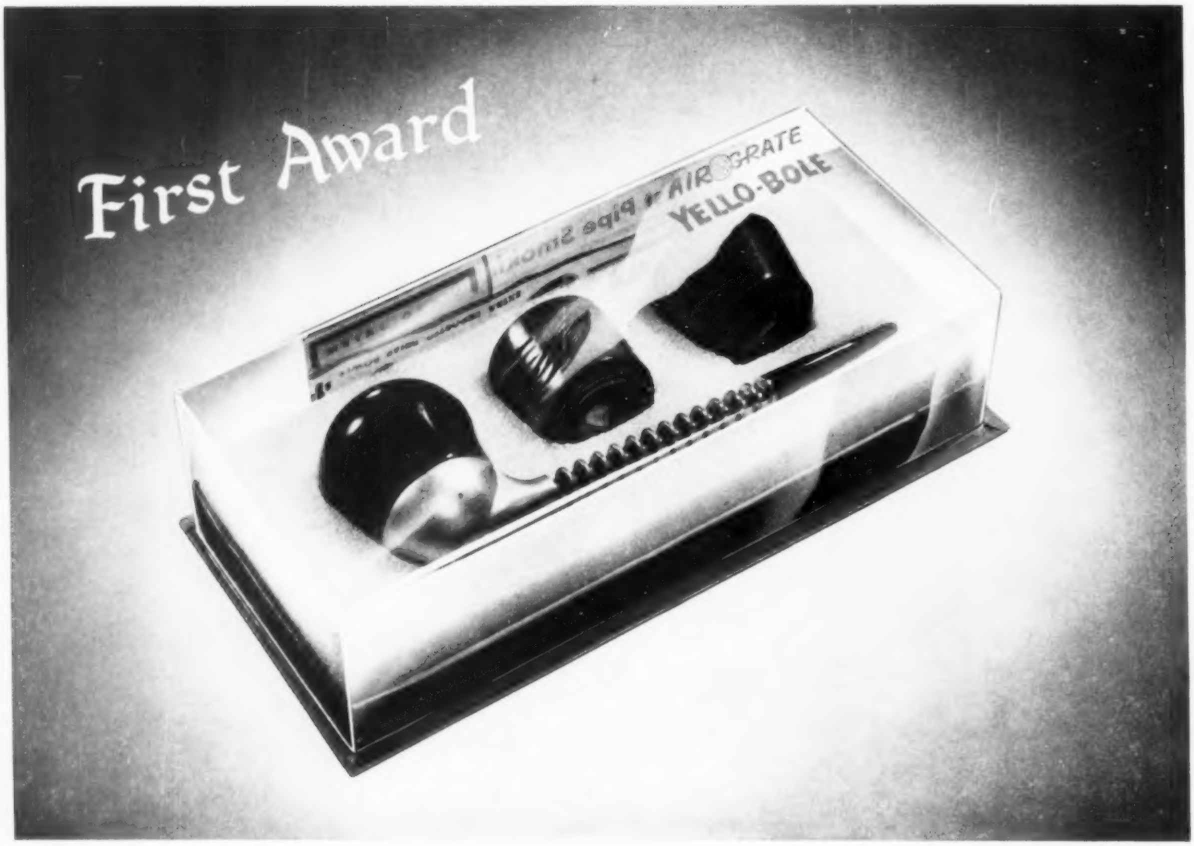
Our compression and injection equipment cover a wide range of sizes. And we can make deliveries to meet your production schedules.

Write today for a free subscription to Plastics Progress, Chicago Molded's data-packed magazine on latest developments in plastics.

CHICAGO MOLDED

PRODUCTS CORPORATION

1046 North Kolmar Avenue, Chicago 51, Illinois



Acetate Sheeting...

by **JOSEPH DAVIS PLASTICS CO.** was used in this square box manufactured on automatic equipment by the **Samuel Barnett Co.,** Philadelphia, Pa., which won a National Paper Box Manufacturers Association award for the best transparent container.

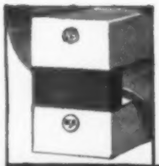
The S. M. Frank Co., New York City, manufacturers of Yello-Bole Airograte Pipes, illustrated above, have discovered that JODA crystal clear acetate shows off their products to maximum advantage, has the excellent impact and tear strength necessary for long shelf life as well as the brilliance and smart fresh look that promotes sales.

JODA extruded acetate sheets, rolls and film in all gauges — transparent, translucent and opaque — are excellent for vacuum forming as well as for fabricating square and round containers. Use it to package <u>your</u> product. You'll discover as so many others have, that <u>seeing</u> it is half of <u>selling</u> it — and your product will be seen best through protective packaging made of JODA acetate. Write for information and samples.

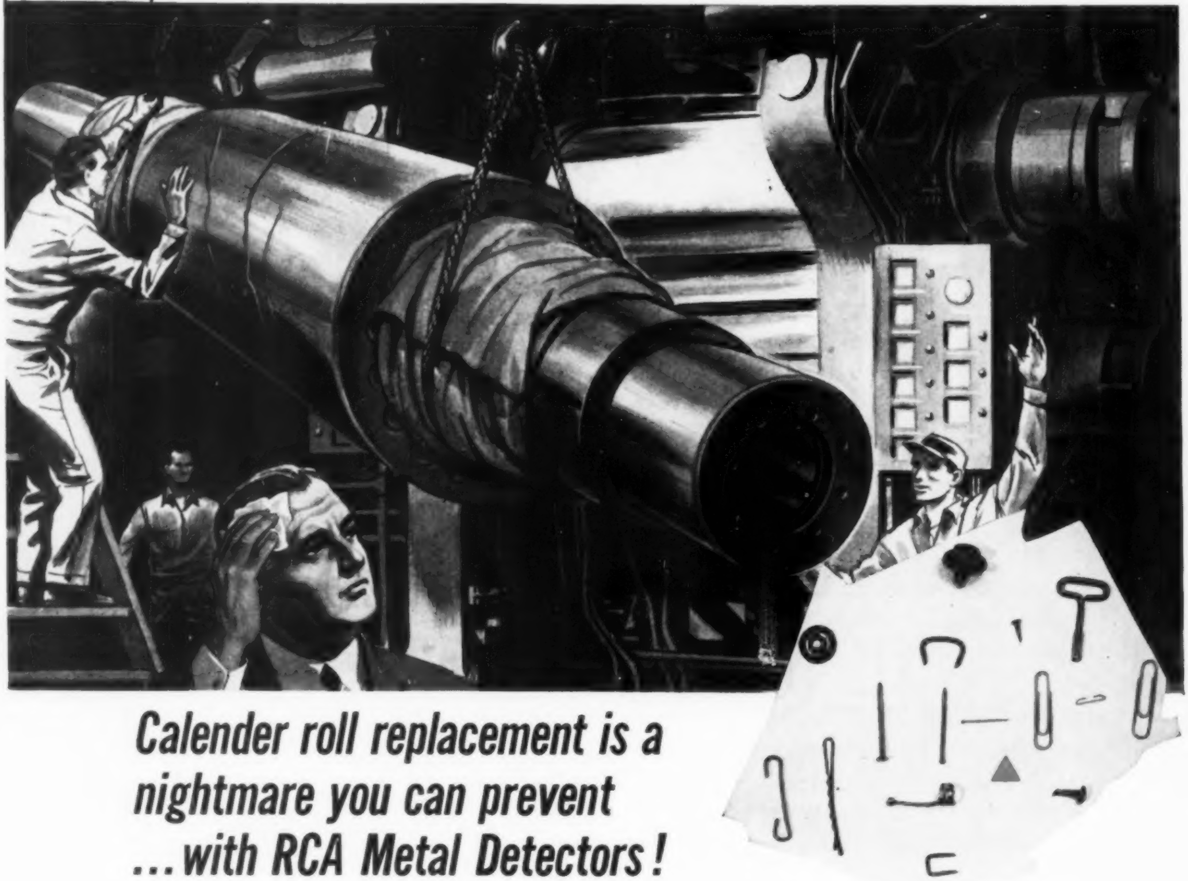
JOSEPH DAVIS PLASTICS CO.

430 Schuyler Ave.
Kearny, N. J.

Phone
WYman 1-0980
N. Y. BArclay 7-6421



...GATEWAY TO SAFETY FROM TRAMP METAL



Calender roll replacement is a nightmare you can prevent ...with RCA Metal Detectors!

If the above picture was only a "bad dream," it wouldn't be worth discussing. Unfortunately, tramp metal damage to calenders DOES cause shutdowns in plastics plants. When this is the case, the loss of production is staggering, not to mention the cost of replacing or regrinding damaged roll! A well-known processor says, "Over the years RCA Metal Detectors have saved us tens of thousands of dollars in detecting foreign matter in our raw products which could damage our calenders. We feel the Detectors are cheap at any price."

Used on strip material traveling at speeds from 15 to 1000 ft. per min., with full inspection sensitivity, the Detector can be arranged to sound an alarm, and/or stop the traveling material. In plant after plant, the RCA Electronic Metal Detector has paid for itself many times over through increased life of costly machinery, decreased downtime, and savings in product. It can be put to work quickly in *your* plant.

Find out today how the RCA Metal Detector can save you money. Write for latest literature, RCA, Dept. P-75, Building 15-1, Camden, N.J.

RCA

Tmk(s) ®

RADIO CORPORATION of AMERICA

CAMDEN, N. J.

RCA
ELECTRONIC
METAL
DETECTOR

Photo courtesy The Akron Preform Mold Company, Cuyahoga Falls, Ohio

New route to really good roto-castings

The most important requirement of a really good vinyl compound for roto-casting is good plastisol flow. This, in turn, is a function of plastisol viscosity and gellation rate and temperature.

The route to just the right combination of plastisol flow and fusion has been greatly simplified by the recent development of a series of formulations based on blends of certain PLIOVIC resins. These resins are PLIOVIC AO, PLIOVIC VO and PLIOVIC S50.

The net result of combining any two of these high-quality, tailor-made PLIOVIC resins is unusually close control of plastisol flow and fusion over a complete range of hardness. What's more, these PLIOVIC blends require smaller concentrations of plasticizer to provide significant production economies and higher physical properties in the end product.

For full details on the advantages of PLIOVIC blends for really good roto-castings, including the latest *Tech Book Bulletins*, just write Goodyear, Chemical Division, Dept. B-9422, Akron 16, Ohio.

GOODYEAR

CHEMICAL DIVISION

Pliovic–T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

IMPACT-RESISTING PVC RIGIDS

Boost their toughness, weather resistance with "Dutch Boy" basic lead stabilization

Ease production, cut stabilization cost, too!

Much is expected of impact-resisting PVC rigids... sheet, pipe, structurals. And "Dutch Boy" *basic lead* stabilization is the economical way to meet customer's expectations.

With "Dutch Boy" *basic lead* stabilization, rigids are measurably stronger, measurably tougher. Impact and rupture strengths, moduli of elasticity all go up.

Weather resistance, too, goes up. That's because "Dutch Boy" *basic lead* stabilizers are efficient... stay on the job through severe heat of processing rigid stock. Exposure tests prove finished products have optimum ultra-violet light and oxidation resistance.

For quality, for economy . . . use "Dutch Boy" DYPHOS® and DS-207®

"Dutch Boy" *Dyphos* and *DS-207* stabilizers give you *basic lead* stabilization at its best...plus two-way economy.

First, among stabilizers suitable for high impact rigids, these Dutch Boy stabilizers cost the least to buy... less than half as much. Second, both greatly ease processing.

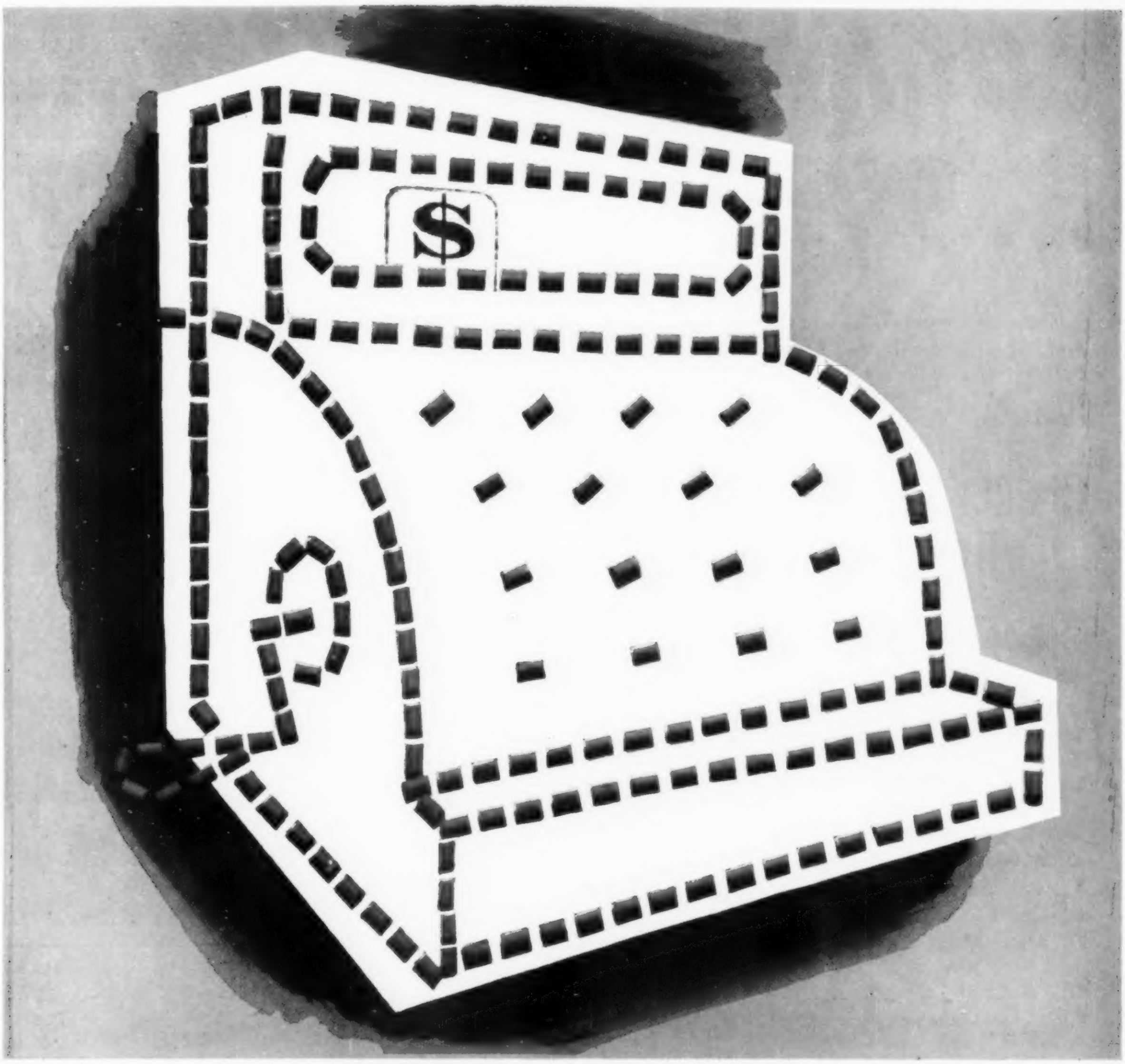
With "Dutch Boy" *Dyphos* stabilizer, control of process conditions is less critical, color problems reduced. It seizes acid breakdown products, blocks the oxidation caused by working non-plasticized mass at high heat. "Dutch Boy" *DS-207* stabilizer provides continuous, single-phase lubrication, evenly distributed. No melting!

Improve the stabilization of your impact-resisting PVC rigids the "Dutch Boy" way. If you need technical assistance just say the word.

Dutch Boy® CHEMICALS

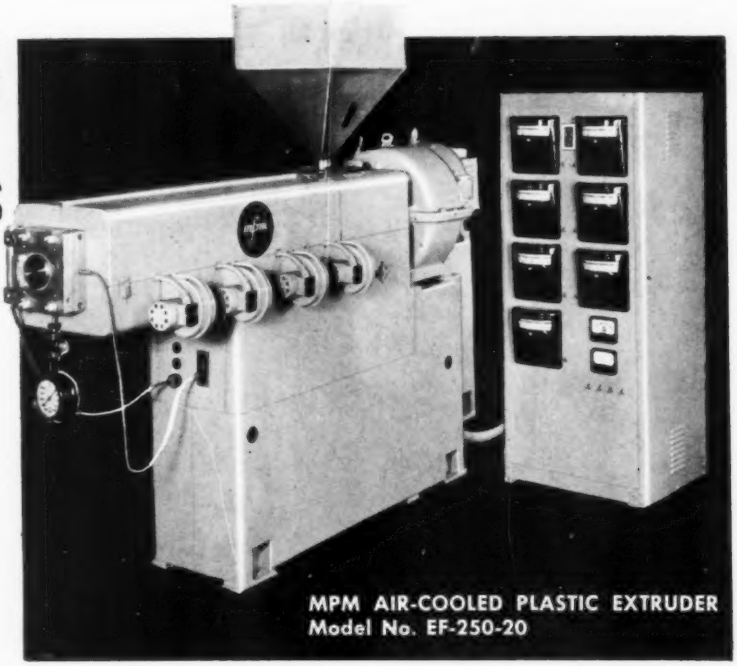
NATIONAL LEAD COMPANY, 111 Broadway, New York 6, N.Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED, 630 Dorchester Street, West • Montreal.



LOOK AT THE OTHERS ...BUT BUY THE BEST!

MPM's sensational new "Century Series" Extruders available in Standard, Hi-Speed and Vented models with screw sizes from 1" to 8".



MPM AIR-COOLED PLASTIC EXTRUDER
Model No. EF-250-20

15 PROFITABLE REASONS WHY YOU SHOULD Buy mpm

1. "Cast-In" Heaters (Induction or Band available).
2. Uniform heat control.
3. Complete control cabinets wired to J.I.C. codes*.
4. One-piece air-cooled cylinders.
5. Xaloy liners in all sizes — 1" to 8".
6. High-thrust bearing capacity.
7. Long bearing life at high (10,000 psi) working pressure.
8. True bearing ratings.
9. Over-size herringbone gear transmissions in 2"-8" sizes.
10. Matched dies, takeups, and accessories.
11. Complete packages fully wired for low cost installation.
12. Screw speed Tachometer — Motor Load Indicator.
13. 16:1—20:1—24:1 Length/Diameter ratio cylinders. (Measured from front of feed opening) (Other lengths on request)
14. Heavy duty construction throughout.
15. Quick opening covers for easy accessibility of all parts.

*Joint Industrial Council.

100% COMPLETE PACKAGED UNITS WITH ALL ACCESSORIES

MPM Extruders are available in screw sizes of 1" — 1½-2" — 2½" — 3½" — 4½" — 6" — 8" with cylinders of 13.1 — 16:1 — 20:1 — 24:1 — LE/D Ratio — with or without vents

MPM Model No.	ESF-100-12 EF-100-12	EF-250-20	EF-350-20
Screw Diameter	1"	2½"	3½"
Le/D Ratio	12:1	20:1	20:1
Heating Load—Watts	1800	12,750	25,000
Heating Zones	2	4	4
Gear Ratio (Standard)	20:1	23.8:1	24.9:1
Transmission HP at 75 RPM	.45	28	37
Type Gears	Worm	Herringbone	Herringbone
Thrust Bearing Capacity Dynamic Load Rating	11,750#	215,000#	400,000#
B-10 Life at 75 rpm	4,000 hrs. at 5,000 psi 32,000 hrs. at 2,500 psi	27,000 hrs. at 10,000 psi 216,000 hrs. at 5,000 psi	25,200 hrs. at 10,000 psi 201,600 hrs. at 5,000 psi
Motor HP	.5	15 - 25	25 - 30
Screw Speed (Standard)	8-80 rpm	7-85 rpm	7-85 rpm
Output per hour	6-12 lbs.	85-135 lbs.	200-250 lbs.
Cooling System—Cylinder	None	Air	Air
Cooling System—Hopper	Water	Water	Water

Note: B-10 Life —
See Anti-Friction Bearing Mfg. Assoc. Stds. Specifications for other size Extruders on request.

modern plastic machinery corp.

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QUALITY MATERIALS REPROCESSED WITH METICULOUS CARE
COMMERCIAL COLOR MATCHES
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CONVENTIONAL AND HIGH DENSITY POLYETHYLENE
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REGIONAL OFFICES: Akron . Chicago . Boston . Los Angeles . Toronto . London
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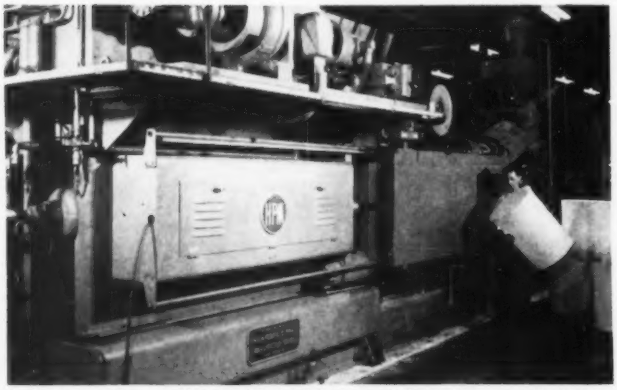


Federal Tool Corp., in 1958, added a 300 oz. and three 80 oz. preplasticizers to its production line. The machine illustrated is a 200 oz.

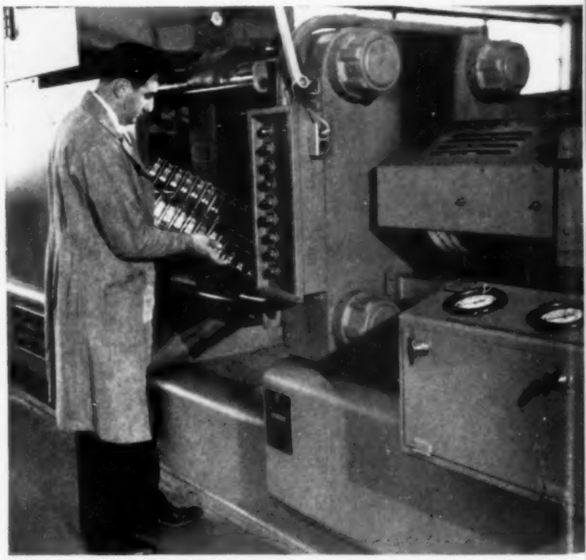
A battery of H-P-M "12s" molding the famous ANDY GARD line of remote control toys at General Molds & Plastics Co.

This H-P-M. 80 oz. preplasticizer increased production 50% on these parts at Minnesota Plastics Corp. They operate 27 other H-P-Ms.

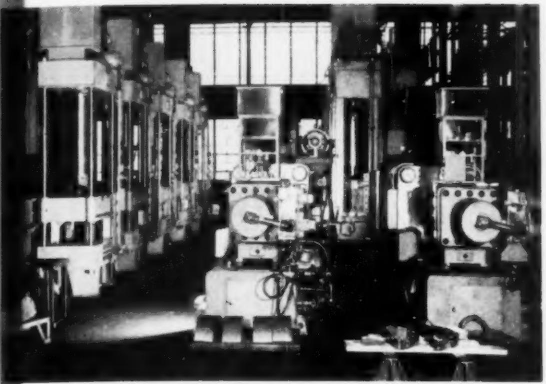
A battery of H-P-M injection machines at Pittsburgh Plastics Corp., a user of H-P-Ms "from the start."

1958: greatest year in H-P-M history for plastic molding machine sales

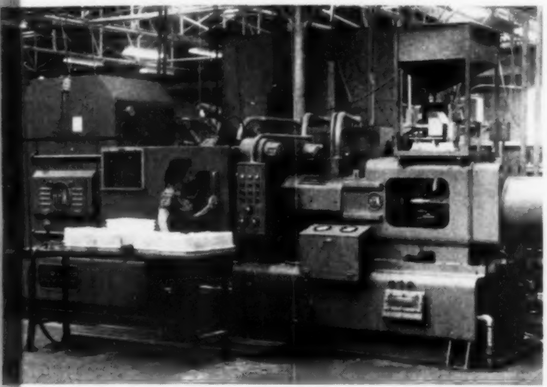
This huge H-P-M 300 oz. preplasticizer is the latest addition to the 21 H-P-Ms in operation at Columbus Plastics Products, Inc.



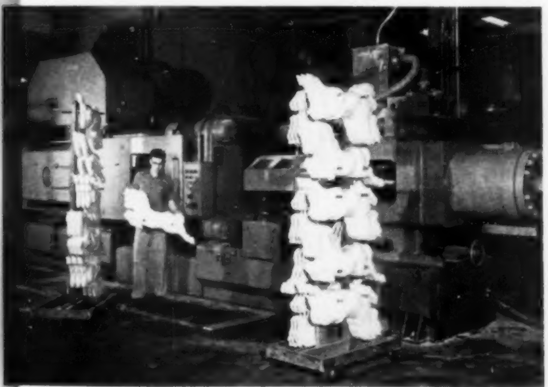
Screw driver handles being molded on an H-P-M 20 oz. at Fibro Corp. Fibro is a 100% H-P-M plant with ten injection machines.



Two large injection machines and five reinforced plastics presses under construction at H-P-M.



An H-P-M 20 oz. machine at Loma Plastics, Inc., a big user of H-P-M plastic molding equipment.



H-P-M 48 oz. machine molding hobby horse halves at Amos Molded Plastics Division, Amos Thompson Corp.

H-P-M 6-oz. injection machines being assembled at H-P-M's Plant 2.

IN spite of a business recession that affected almost every industry in 1958, H-P-M was recording the best sales year in its history for plastic molding equipment. Two conclusions can be drawn: First, plastics has attained the status of a prime material in many new industries; second, H-P-M's confidence in this growth potential, as far back as the late '20s, has resulted in the most comprehensive line of molding machinery now available.

Constant research and development, at H-P-M has improved molding techniques. New injection machines have hydraulic systems with independent control for both clamping and injection circuits, better heating chamber design, new improved preplasticizing equipment and faster production speeds than ever before.

A wide-awake field engineering and service organization maintains close contact with the needs of this growing industry. A complete listing of the H-P-M field staff is shown below. These specialists are ready, and able, to help with your molding problems. Experienced service engineers are strategically located to keep your H-P-Ms producing at top capacity — *for highest profits.*

HERE'S THE TEAM THAT RATES THE CREDIT FOR 1958

ATLANTA, GEORGIA
Chandler Machinery Co., Inc.
R. R. Almand
G. A. Teck
J. H. Tatum
J. G. Carroll
E. J. Brewer, Jr.
J. C. Cowan

CAMBRIDGE, MASS.
Austin-Hastings Co., Inc.
Fred Allen
Robert Carlson
Joseph B. Lanza
Frank Smith
George H. Guillet
William A. Rising
H-P-M Service Engineer
Allen Callahan

PARK RIDGE (Chicago), ILL.
The Hydraulic Press Mfg. Co.
Don C. Youngblood
B. D. Ashbaugh
H-P-M Service Engineers
Carl Gompf
W. Siljenberg
Solomon Seif

COLUMBIA, S. C.
Tidewater Supply Co., Inc.
R. S. Paschal, Jr.
W. F. Wannamaker
R. S. Paschal
J. E. Payne

DALLAS, TEXAS
Tri-State Machinery Co.
H. T. Smith
M. Cromeens
Loyd Morgan
Kenneth Neumann

DENVER, COLORADO
The Mine & Smelter Sup. Co.
F. H. Erhard
W. J. Edwards
J. W. Harrison
H. J. Todd
B. J. Malone
C. H. Carter
C. H. Schmitt
G. O. Clapham
E. R. Roberts

DETROIT, MICHIGAN
The Hydraulic Press Mfg. Co.
A. S. Linzell

EL PASO, TEXAS
The Mine & Smelter Sup. Co.
James Henry
R. C. Bowen
Stanley Ochocinsky
L. P. Argenbright

HOUSTON, TEXAS
The H. L. Thompson Co.
J. B. Thompson

KANSAS CITY, MISSOURI
Blackman & Nuetzel Mch. Co.
Edward H. Ruder
Wm. Lee Williams

KNOXVILLE, TENN.
Tidewater Supply Co., Inc.
W. L. Smith
N. W. Hicks
G. F. Foster

LOS ANGELES, CAL.
Machinery Sales Company
Merle M. Barron
Donald J. Lewis
Ray I. Harris
H-P-M Service Engineer
W. H. Hickman

MOUNT GILEAD, OHIO
The Hydraulic Press Mfg. Co.
William Croll
Robert Haas
Leon Davis
W. G. Kriner
F. D. Barrick
H-P-M Service Engineers
Lloyd Harris
Raymond Bowers
Charles Piercy
Frank Davis
Robert Wirick
Russell Frayer

NEW ORLEANS, LOUISIANA
Frederic & Baker
H. R. Baker

(New York) TEANECK, N. J.
The Hydraulic Press Mfg. Co.
C. J. Ziegfeld
Charles Mock
L. J. Quitoni
H-P-M Service Engineer
George Coveney

OMAHA, NEBRASKA
Fuchs Machinery & Sup. Co.
J. J. Fuchs
Hal Morris
Doug Gaines
Lloyd Harney
Dwight Wadhams

ORLANDO, FLORIDA
Harry P. Leu, Inc.
Glenn Sites
Hillman G. Baggett
Lee Wetherbee

PITTSBURGH, PA.
The Hydraulic Press Mfg. Co.
John E. Parks
H-P-M Service Engineer
Chester Beam

PORTLAND, OREGON
Hallidie Machinery Co., Inc.
Dan J. Melody
Jack Wright

RICHMOND, VIRGINIA
Smith-Courtney Co.
B. H. Smith
E. C. Davis

W. J. Clark
A. K. Pearson
J. P. Abernethy

ST. LOUIS, MISSOURI
Blackman & Nuetzel Mch. Co.
Arlington Nuetzel
William V. Nuetzel
William A. Crane
Gene Moore
Walter Traber

SALT LAKE CITY, UTAH
Todd Machinery Co.
Harry J. Todd

SEATTLE, WASHINGTON
Hallidie Machinery Co., Inc.
Paul E. Forsythe
Fred Wellington
Roger B. Norman
Loren St. Peter
Warren J. Barlow
H-P-M Service Engineer
W. H. Hickman

SHREVEPORT, LOUISIANA
Frederic & Baker
Harris Frederic
J. W. Sandifer, Jr.

SPOKANE, WASHINGTON
Hallidie Machinery Co., Inc.
James R. Mohondro

SOUTH SAN FRANCISCO, CAL.
B. H. S. Machinery Co.
Andre Bjornskov
E. R. Bate
B. H. Bruning
Frank R. Christ, Jr.
Roy Fennimore
Robert C. Glazier
Otis Green
C. M. Hoffner
John D. Marine
Tom Sawyer
David J. Studabaker
H-P-M Service Engineer
W. H. Hickman

TULSA, OKLAHOMA
Blackman & Nuetzel Mch. Co.
Barr McDermott
Clyde J. Hunt

WASHINGTON, D. C.
The J. H. Elliott Co.
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HPM

H926

THE HYDRAULIC PRESS MFG. COMPANY
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U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

FEBRUARY, 1959 U.S. INDUSTRIAL CHEMICALS CO., DIVISION OF NATIONAL DISTILLERS AND CHEMICAL CORPORATION, 99 PARK AVE., N. Y. 16, N. Y.

Packaging Notes

New rim seal packaging machine that effects considerable savings in time and packaging film is being placed on the market. The hand-operated machine was designed for use in small food packaging operations, such as are common in super markets. The machine seals polyethylene film to the rim or lip of the food tray or container in a single operation. By eliminating the extra film that normally is folded and sealed under the tray, the machine reportedly saves almost 60% of the amount of film needed to make a sealed package. It is claimed that the machine can produce three to four times as many packages in a day as can be made by present hand wrapping methods.

The machine employs an electrically heated and thermostatically controlled upper section which is brought down on the film to make the rim seal. The heat sealing surfaces can be changed quickly for almost any size or shape of container. A set of sealing shoes for conventional package sizes and shapes is included with the machine.

Pressure-sensitive, paper-backed polyethylene tape solves problems of joining and patching poly film used in agriculture and as a water vapor and dust barrier in the construction field. The tape is easily applied by removing the paper backing and firmly pressing the tape smooth. The tape meets general building requirements, including FHA specifications.

Grain and silage can be packaged and preserved in poly bags, according to a study made at a leading Midwest agricultural school. Previous attempts to accomplish this with conventional bags failed because the bags permitted air to enter the package, spoiling the high moisture silage. Polyethylene reportedly lets gas escape, but prevents air from entering.

A new process permits polyethylene coated bags and cartons to be run on standard glue-sealing machinery at high speeds, using low-cost dextrin and starch adhesives. The process is expected to increase sharply the use of polyethylene-coated materials for packaging.

Possible applications include boxes for chlorinated powdered detergents, cereals, cake mixes and other products requiring sift-proof containers. Need for a loose inner liner would be eliminated. Polyethylene-coated cartonboard for frozen food packages would also cut costs by eliminating the need for overwraps.

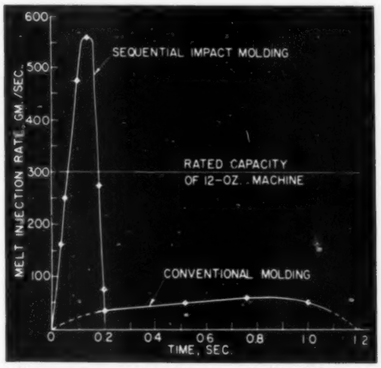
First commercial use for the process is in packaging personal hygiene products in a box made of polyethylene-coated paperboard. The coating replaces a glassine-paper laminate.

Sequential Impact Molding: New Technique Increases Output, Simplifies Fill Control

Method Based on Precisely Timed Release of Precompressed Melt

A radical improvement in the still new technique of impact molding was announced recently. Called Sequential Impact Molding (SIM), the new method reportedly yields from 30 to 50% more pounds of finished pieces per hour than the best yields for the same equipment employing conventional procedures. Mold filling rate is said to be increased six-fold.

In ordinary impact molding, the melt is precompressed, then "exploded" into all the mold cavities at one time. With SIM, the cavities are filled in carefully timed sequence, with each cavity receiving the full pressure of the injection setup. Sequencing is achieved by timed opening and closing of the valves in a multiple-nozzle manifold. The advantage of this method over sequenced valve gating is that all the special equipment is in the injection end of the machine rather than in the mold. One valving setup may be used for many different molds.



Filling rate graphs for two half-gallon containers molded under identical conditions by sequential impact molding and by conventional means.

Faster Filling Speed

In addition to increased output, one of the biggest advantages of SIM is reported to be the speed with which the cavities are filled. With SIM, cavity filling is so fast that mold temperature is no longer critical and amount of flow into the mold is more easily controlled. This speed also eliminates core shifting and weld lines by reducing the usual large, around-the-cavity pressure gradients that are responsible for core shifting in bottom gated cavities. SIM is also said to eliminate warping of thin sections caused by locked-in stresses.

Sequential opening of the valves also reduces clamp requirements, since only one cavity or group of cavities is filled at any one time. Thus, clamping force needed is much less than if all the cavities were filling together. This permits an increase in the number of cavities without undue concern for clamping capacity.

Equipment for SIM is being made and sold under license from the company which developed the technique. Both new molding machines and conversion kits for adapting existing equipment are being offered.

Booklet Describes Chemical Growth of National Distillers

A full color brochure describes the growing contribution to the chemical industry of National Distillers and Chemical Corporation. The 36-page booklet takes readers on a photo tour of plants operated by U.S.I. and its affiliated companies. Products of these operations — polyethylene, petrochemicals, agricultural and industrial chemicals, corrosion-resistant metals and high energy fuels — are described.

The brochure may be obtained by writing Editor, U.S.I. Polyethylene News, U.S. Industrial Chemicals Co., 99 Park Avenue, New York 16, N. Y.

To Wrap 1500-Mile Pipeline With Polyethylene Tape

Work has begun on a $3 million contract to wrap an entire 1500-mile pipeline with polyethylene tape. Although poly tape has been used extensively as a protective wrapping for pipelines, this reportedly is the first time that a major system has been completely wrapped with tape.

The pipeline runs from Baton Rouge, La., to Cutler, Fla. and is made of pipe varying from 18 to 24 inches in diameter. The contract represents the largest single order ever placed for a protective pipe coating of any kind.

Poly Wraps Win 32 Awards In Packaging Competition

Polyethylene bags and wraps took a total of 32 prizes recently in the third annual Flexible Packaging Competition, sponsored jointly by the National Flexible Packaging Association and Paper, Film & Foil magazine. Poly packages won more awards than were given to all other packaging materials combined. The top award of the competition went to a polyethylene package for girdles.

POLYETHYLENE PROCESSING TIPS

U.S.I.

Vol. IV, No. 1

PRINTING ON POLYETHYLENE FILM: HOW TO GET BEST RESULTS IN FLEXOGRAPHIC PRINTING

In the last edition of "TIPS" (Vol. III, No. 6) a review was made of the methods for pretreating polyethylene film surfaces so that commercially available printing inks will adhere well. Since most commercial printing on polyethylene film today involves the use of flexographic techniques, this method of printing film after it has been surface-treated has therefore been chosen as a topic for discussion. Film processors who have just acquired flexographic printing equipment and those who plan to add such equipment should find this of particular interest.

Performance of Flexographic Inks

Because polyethylene is nonabsorbent toward inks, even after surface-treating, the commercial flexographic inks developed for printing on this material are of the nonabsorbing type. They are relatively fast-drying, and usually possess high gloss. They do not require high temperatures for drying.

In general these inks are composed of a solvent vehicle, a resin binder and pigment plus various additives to impart gloss, etc. The drying speed of an ink, important in rapid multicolor printing, depends on the solvent vehicle. Combination solvents are generally used for flexographic inks so that drying speed can be varied readily by changing the solvent mixture ratio. Where hydrocarbon-type solvents such as naphtha are used, *synthetic rubber* plates and rollers must be employed to prevent swelling and deterioration.

While the resin binder in the ink acts as the adhesive agent, the gloss and antiblock additives play an important role. Formulations must be checked constantly by the ink manufacturer for proper adhesive properties.

Some Printing Hints

Processors should keep in mind that solvents used for different types of inks – such as hydrocarbon inks and alcohol inks–are usually not miscible and should not be mixed.

Most flexographic inks require constant mixing by recirculation or other methods to maintain color uniformity.

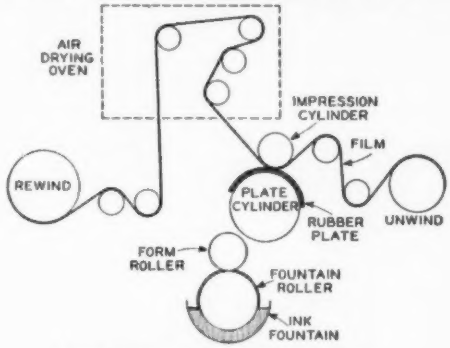
The first ink down in a multicolor printing operation must be the fastest drying and each successive color can be slower. Also, in a multicolor operation, it is desirable to print lighter colors first, followed by darker inks. This prevents noticeable color contamination that would otherwise occur.

Here is an important fact to remember in printing on extremely thin gauge film. Such film is usually surface-treated very lightly, thereby increasing the possibility of poor ink adhesion. In this case it is often possible to place a base ink on the film surface over the same areas to be printed later. This base ink may possess high adhesion but poor gloss and antiblock. However, overprinting with other inks will remedy these poor qualities. The adhesion of ink-to-ink is much greater than ink-to-polyethylene, and so overprinting with glossy inks will result in both desirable adhesive and appearance properties.

Tests for Satisfactory Printing

If the processor does not extrude, surface-treat and print all in line, it may sometimes be necessary to test unprinted film to see if it has already been treated. Visual inspection will not give the answer. However, ability of the film to be wetted by water is increased after treatment, so that a determination of wetting characteristics will reveal the extent of treat.

The Scotch Tape test, described in U.S.I. Polyethylene Processing Tips, Vol. III, No. 6, as a control in the surface-treating operation, is also used to determine how well the ink is adhering to the printed film as it comes off the press. Here the tape is applied to the printed film after drying. It is then drawn back slowly over about half its length and rapidly pulled off the remaining area. Printing is satisfactory if no ink is removed from the film.



Schematic diagram of flexographic printing process.

U.S.I. Will Advise

This has been only a brief summary of some of the more important phases of flexographic printing on polyethylene film. As a manufacturer of polyethylene resins, U.S.I. has studied the subject in some detail and is equipped to help the processor with his printing problems.

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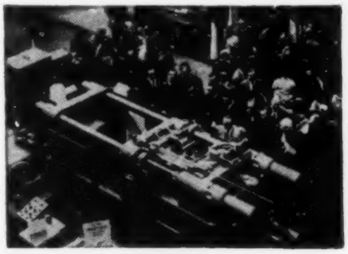

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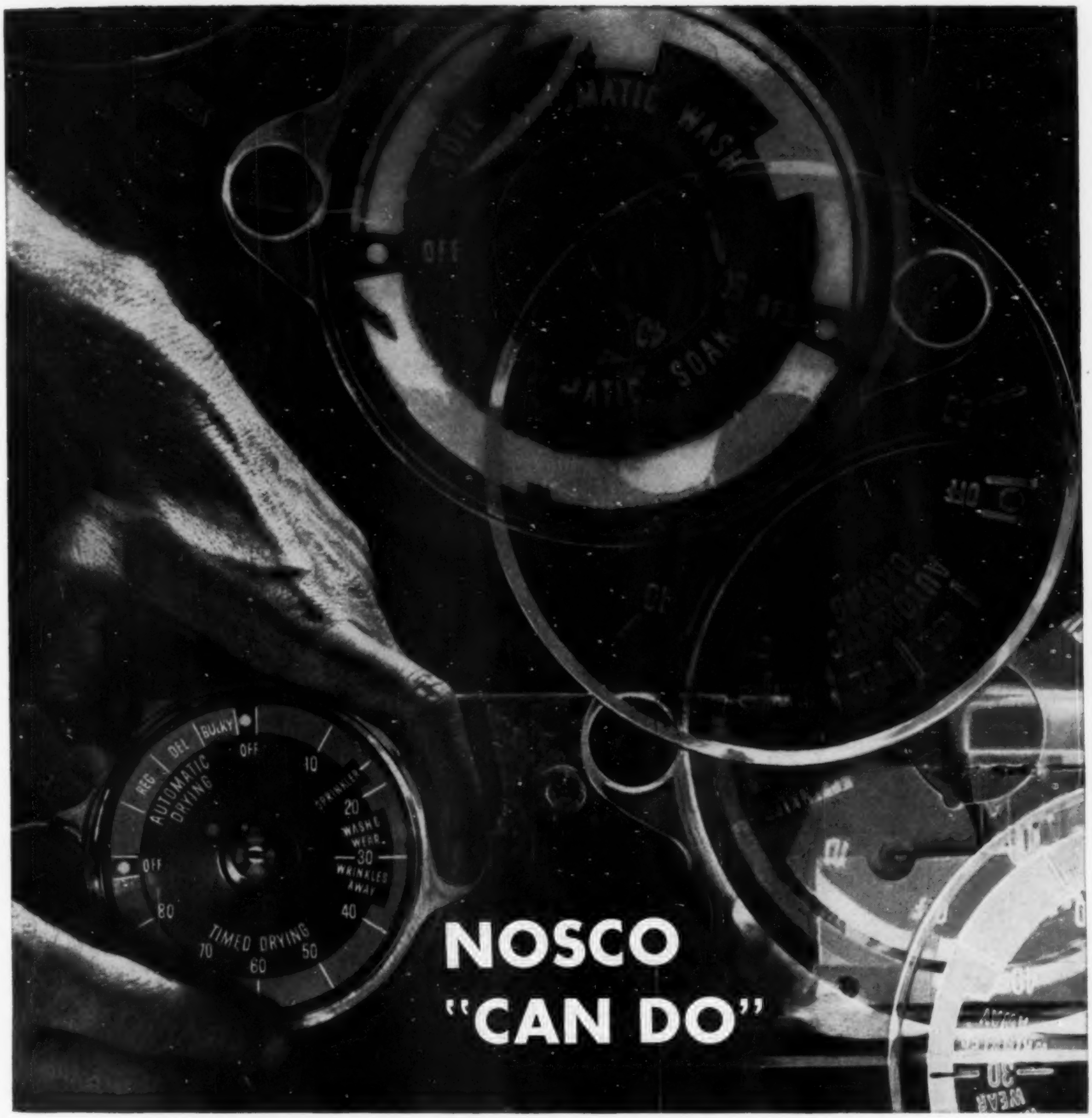

Redesigns decorated plastic dial . . . steps up production rate 30%

Those hands belong to a busy appliance manufacturer. That dial he's attaching to the backsplasher may be small, but it once presented a man-sized production problem! That's when he came to Nosco and said "These specs on our new decorated acrylic dials are tough. They involve a complex, cup-shaped section with remote lettering. But we still want costs kept low. Can do?"

Nosco said "Can do—better and cheaper. Let us redesign each complex dial into two pieces that are easy to mold and easy to assemble. We'll hot stamp two colors at a time. And then, with this new design we can spray paint and wipe automatically. This way, costs are cut, production increased, and quality kept high."

The result: 2500 completed washer or dryer dials per shift—*30% more production* at no increase in cost! That's what Nosco "Can do" did recently for one happy manufacturer.

And Nosco "Can do" for you, too. We like tough injection molding and decorating projects. Let us show you how we can produce your plastic parts in volume, and perhaps cut costs by redesign. For more information call or write.

NP-59-01

NOSCO plastics, inc. • erie 5, pa. *One of the world's great injection molders*

A partial view of Hassenfeld's 12-Ounce Lester Installation.

LESTERS ARE "BASIC FACTOR" IN HASSENFELD'S AGGRESSIVE MOLDING

One of the hottest toys on the market and, at the same time, a fine example of superior molding technique, is the toy bowling pin project currently running at Hassenfeld Bros., Inc., at Central Falls, R.I.

The initial problem was to plan a product in four sizes that would stand up both literally and figuratively, compared to low-cost blow-molded parts and still be competitive in price with them. Naturally, they had to have the largest mold with greatest number of cavities possible for each part, consistent with a fast cycle.

Once again the wisdom of owning Lesters became evident to the Hassenfeld team. To quote Mr. H. P. O'Connor, of their mold engineering and design department, "The expanse of the platen area, the projected area, the amount to be plasticized, and the clamping and injection pressures of the 12-ounce Lesters were the factors in our pursuing this program. I might add here that had we not been fortunate to have these machines at our disposal, this whole story might not have come into being."

The molds were designed with unusual ingenuity. For example, on the #4 (largest) pin top, one double-acting cylinder first pulls the top cores and then the bottom cores, an action which is startling at first sight. In open extended position the mold measures 84 inches vertically, with 1/8″ clearance between the beams of the one-piece Lester frame. The shot, in polyethylene, weighs about 10 ounces.

It is this type of imaginative, aggressive injection molding which proves the capability and versatility of Lester injection molding machines.

Do you have a tough project planned? Check what Lesters can do to help you.

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China in the ninth century reached a peak of splendor and civilization. Many arts, among them the potter's, were exquisitely developed. Pigments and glazes were used in delicate and bold combinations that displayed a superb command of color.

The color of one renowned Chinese ware was described to be as "blue as the sky seen between the clouds after rain." While our color engineers might find this poetic specification somewhat unusual . . . they are proud that to date they have successfully matched over 4000 commercially used colors and shades. For the past twelve years our company has pioneered the use of color in plastics . . . with formulations that give you excellent temperature and flow characteristics . . . without degrading, migrating or leaching.

WESTCHESTER PLASTICS compounds concentrates of color and ready-to-use color blends of conventional and linear polyethylenes and other thermoplastics. When you see WESTCHESTER stamped on your containers of resin, you know that *you are using the custom color that you specified. Write now for detailed information on your thermoplastic color requirements.*

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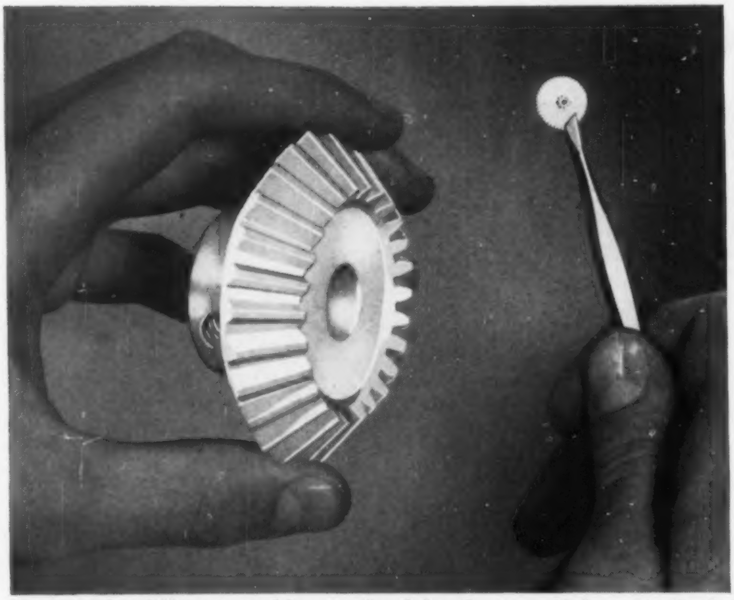
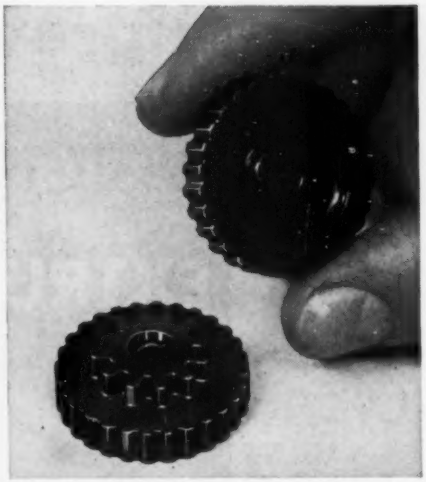


Two vastly different problems solved by Spencer Nylon—that's the story behind these two gears. With the tiny gear at the right, it was necessary to maintain very close tolerances, and there had to be a complete absence of flash, air bubbles, etc. Says the manufacturer, "This is the most critical gear we mold out of Nylon, and we have never seen a gear molded to such exacting specifications." Using Spencer Nylon to mold the big gear at the left eliminated the problem of flow lines and permitted complete fill with no scorching!



"We get a higher gloss, better fill and less flow lines when we mold this combined Spur Gear and Index Wheel with Spencer Black Nylon. We now use Spencer exclusively for this molding."

Leading fabricator reports:

"For Miniature Precision Moldings: Spencer Nylon"

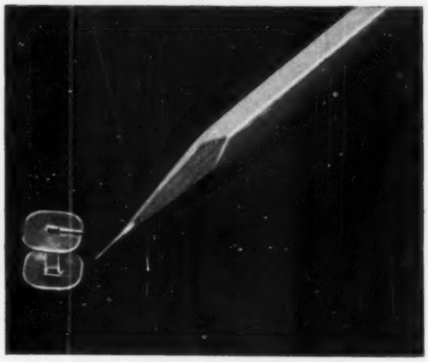
Special properties of Spencer Nylon mean fewer rejects even in close tolerance molding

Maintaining close tolerances in molding a product with a small surface area can be a major problem—if you haven't yet discovered Spencer Nylon! The answer to many a molder's prayer, Spencer Nylon has proved its value time after time in miniature moldings with very thin cross sections.

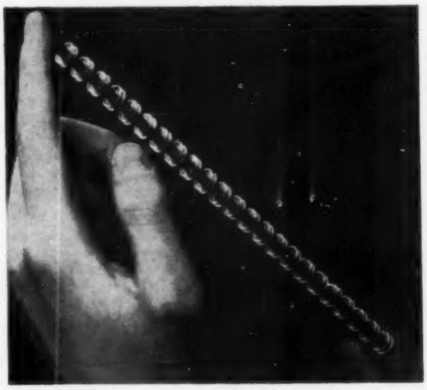
One of the many satisified users is United Fabricators & Electronics, Inc., of Stillwater, Minn. A few of the products they mold from Spencer Nylon are shown on this page. In describing the Commercial Coil Form pictured at lower right, they say:

"We found it impossible to mold them out of any material other than Spencer Nylon . . ."

If you have a problem-product, investigate the advantages offered by Spencer Nylon. For complete information, write to Spencer Chemical Co. at address below:



"We didn't know whether we could even mold this miniature bobbin due to the extremely thin sections. However, the bobbins molded extremely well out of Spencer Nylon, as shown above."



"We had quite a problem molding these 23 miniature Nylon bobbins on a phenolic tube, because of the very thin sections involved. We actually couldn't mold them out of any other material than Spencer Nylon—which *definitely* proved to us that Spencer Nylon is compatible with thin sections."

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FAST...
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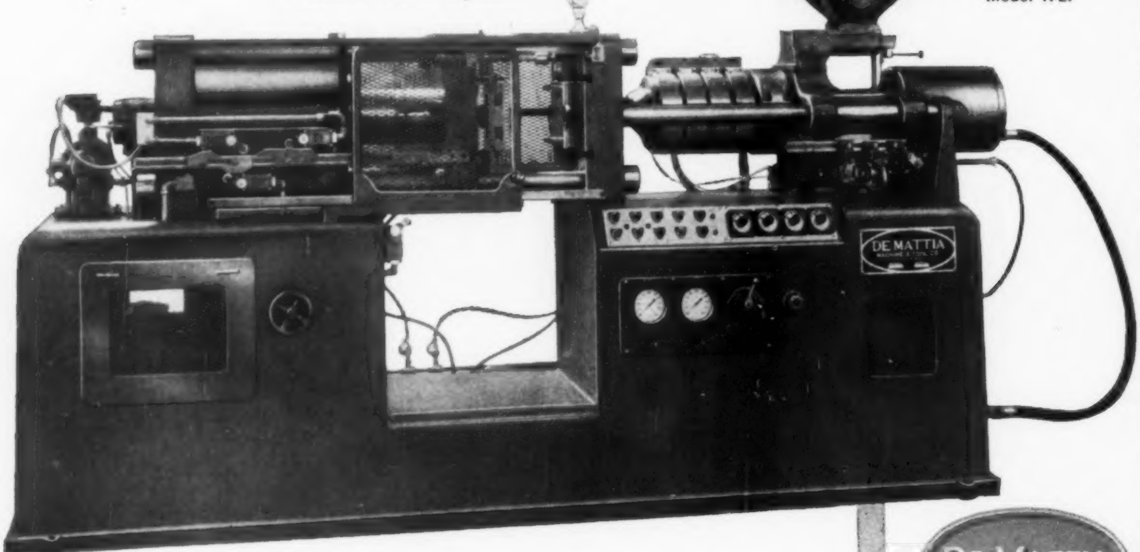

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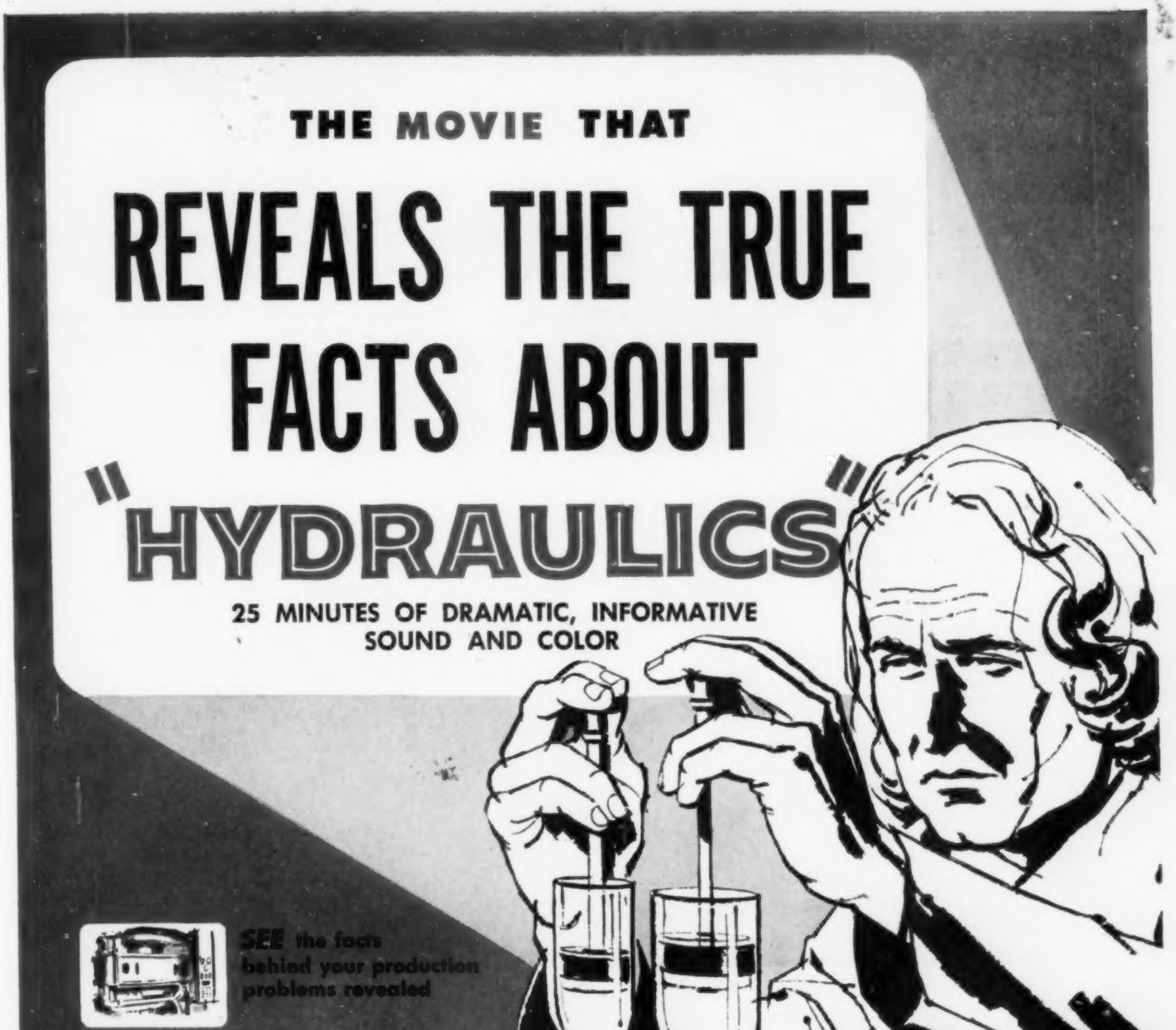
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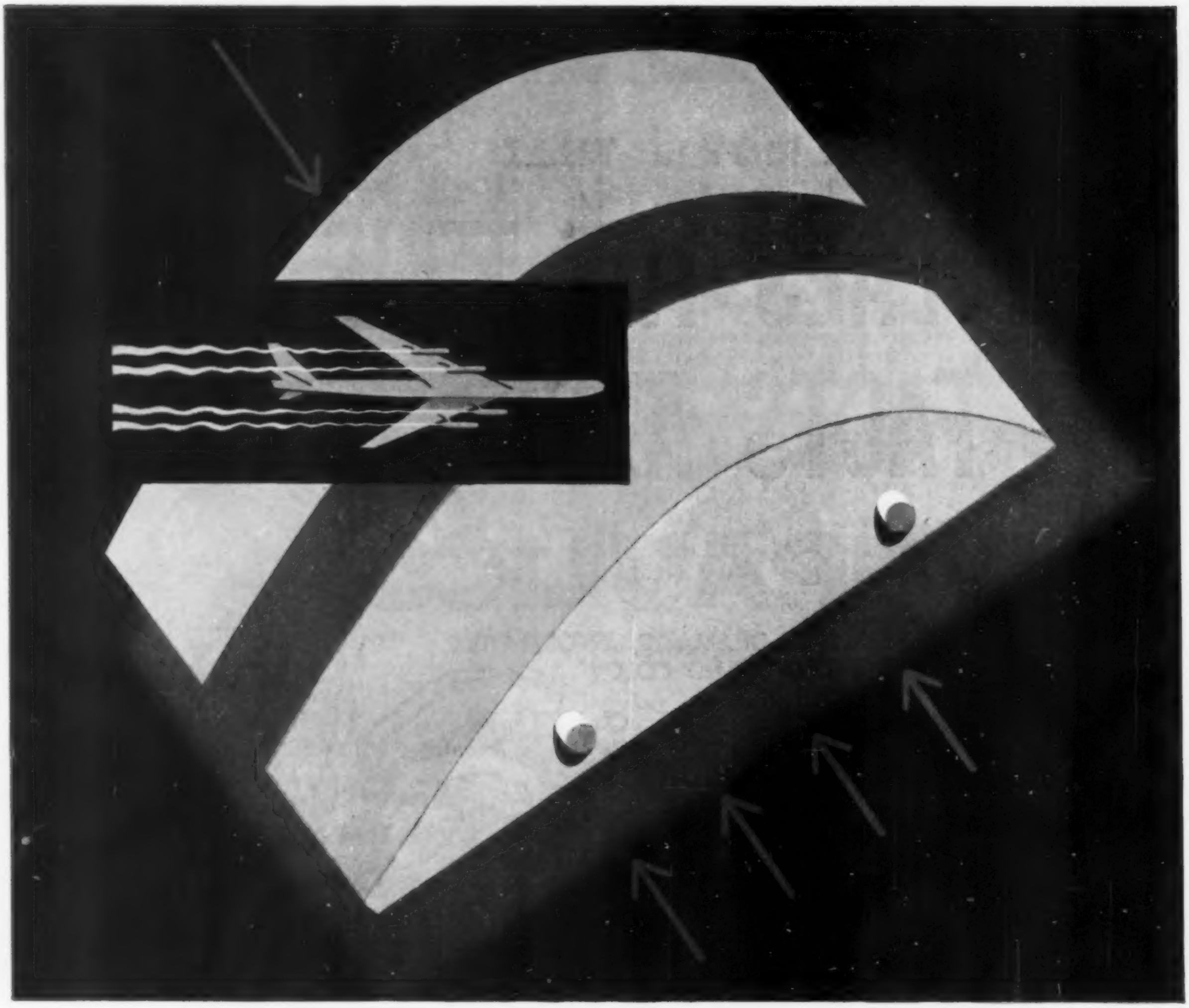

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Easy modification: Tools and fixtures made from Epon resins may be quickly and easily modified to incorporate design changes.

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The combination of resin formulator's skill and practical knowledge, backed by Shell Chemical's technical research and experience, has solved many important tooling problems for industry. Your own formulator specialist can help you solve yours. For a list of experienced tooling resin formulators and additional technical information, write to:

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SHELL

THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 1

February 1959

New list price for low-pressure processed polyethylene. When Phillips Chemical Co. recently reduced the price of its high-density, or linear, polyethylene to 38¢/lb. from a previous 43¢, it set into motion a chain reaction with various effects in the plastics industry.

No one was particularly surprised, since the action has long been contemplated and was certain to come in an industry that has a capacity of over 300 million lb. and had sales of only 55 to 65 million lb. in 1958—with much of that quantity going for export. And a sizable portion of the material sold is probably still in inventory. Phillips announced that the move was made to meet competition, which could mean either other low-pressure polyethylene producers or other plastics materials.

There has been much talk that users rarely paid the full 43¢ anyhow, but producers insist that most of this talk was greatly exaggerated. They all agree however that various types of arrangements used to be made, such as aid in promotion and furnished molds, and off-grade material was sold at various prices. This of course is nothing new in plastics, particularly for a new material.

Constructive features in Phillips' new move are that it will stabilize the price; minimize special deals; and is a realistic approach to adjustment with the 35¢ price of conventional PE. A 3¢ differential is reasonable—the properties, such as stiffness, heat resistance, surface gloss, etc., may well be worth the extra 3¢/lb. for many applications, but the former 8¢ differential was too much to pay for those advantages.

Will the lower price move high-density PE? Most of the high-density, or linear PE, used in the U. S. today, either blended or straight, is for molding. A great portion of the conventional PE used for molding is 32½¢/lb., so there is still a 5½¢ difference for that particular variety. A housewares trade paper recently printed a page full of various molders' reasons why the price reduction didn't mean much to them; but this column is willing to go on record in predicting that high-density PE will soon move into the molding field in large quantity—in five years it may be in larger quantity than conventional PE—providing the price differential becomes no greater than it is now. The properties of high-density PE are such that it can't be ignored, and most molders will get on the bandwagon once they see their competitors riding on the crest of a profitable venture in linear PE. And some of these ventures are just about to open up.

Other markets ready for exploitation include monofilament for rope and some types of woven tapes or fabrics. A big market in blow molded bottles and toys is almost a foregone conclusion, in fact, is already under way. Pipe, wire coating, and paper coating are not yet ready, although high-molecular-weight resins for pipe looks extremely promising. *(To page 45)*

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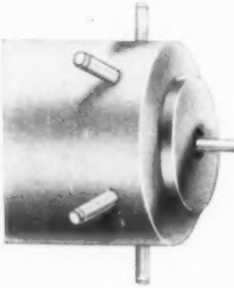
now approved for production of clear plastic tubing



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Every phase of Vygen production—from raw material through glass-lined equipment to final packaging—is carefully controlled and tested to assure a perfect product. Vygen puts outstanding quality, absolute uniformity, good clarity, heat stability and long life into any extrusion, and dry blends with either polymeric or monomeric plasticizers. Write now for information on how versatile Vygen fits your needs.

TYPICAL ANALYSIS

Form—White powder
Intrinsic Viscosity—1.18
Specific Gravity—1.40
Bulk density, gm/cc—0.52
lbs/ft^3—32.5
Volatiles—0.2

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Creating Progress Through Chemistry

THE PLASTISCOPE

(Continued from page 43)

High-density PE film should begin to move to market in fair quantity by next fall. According to a Koppers advertisement, there is now a high-density film on the market but applications are few as yet. It is believed that a copolymer film will eliminate many of the characteristic troubles of high-density resin film, but it will probably move into other markets than those now occupied by conventional PE film. The copolymer resin for film will sell for the same price as high-density molding material.

Effect of new price on other polyethylenes. The lowered price of high-density PE has as yet had no effect on the price of high-pressure-produced PE. Most producers of the latter are selling close to their capacity with but little competition from low-pressure material. They sold 760 or 770 million lb. in 1958 and manufactured less than 800 million. There is little inventory on hand.

The high-pressure producers have a price list that varies all the way from 32½¢ to well up in the 40's, depending upon the type of resin purchased. Pipe resin, for example, is 37½ or 38¢ and electrical grade well up in the 40's; but, of course, their biggest volume is 35¢ material. It should be noted that the low-pressure producers also charge a premium for electrical grade, although their pipe grade is the same as molding material. They too will have a wide range of prices when their materials are better established.

Medium-density resins. Some of the medium-density high-pressure-produced materials that go over 0.930 density, range from 37 to 42¢ and may become vulnerable to the 38¢ low-pressure material in the molding grade; but medium-density film grade resins are expected to hold their present price level for some time, since they are claimed to have properties of hardness or toughness, clarity and easy handling that can't yet be matched by low-pressure PE.

And not to be overlooked in this situation is the fact that high-pressure polyethylene producers are prepared to lower their present 35¢ price if threatened by competition from other materials on a price basis.

Price reaction in polypropylene. Hercules promptly met the price reduction in low-pressure PE by reducing the price of Pro-fax polypropylene by 7¢/lb., which now makes it 42¢/lb. for molding, 44¢/lb. for film grade. Polypropylene is expected to compete with low-pressure processed polyethylene in many applications but according to the producers is worth a few cents more per pound because of different properties.

The specific gravity of polypropylene is 0.900 compared with between 0.950 to 0.960 for most grades of low-pressure processed PE. Therefore, when comparing prices of the two, a rough calculation would show that a 38¢ polyethylene is about equal to a 40¢ polypropylene on a volume basis.

Polypropylene sales are still quite modest, but there are scores of use-tests under way in molding material, monofilament, film, and pipe, some of which are expected to develop into big volume within the year.

Miracle month for plastics. October 1958 was the month responsible for making plastics materials sales higher in 1958 than in any preceding year, according to figures in the Tariff Commission's monthly reports. Without the *(To page 47)*

TITANOX* to the rescue! Part of the appeal of vinyl-covered furniture lies in its light or pastel finish . . . and part of the appeal of TITANOX titanium dioxide white pigments is how economically they produce properties of whiteness, brightness and opacity in plastic or rubber stocks. Whether your formula calls for TITANOX-RA, TITANOX-RA-50 or TITANOX-RA-NC, you'll find these leading white pigments a pleasure to work with—in uniformity that permits easy regulation of opacity and tint, in the contribution they make to product durability, and in ease of processing. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities.

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THE PLASTISCOPE

(Continued from page 45)

almost unbelievable sales volume in that month, total sales in 1958 would have been under 1957. October has always been a top month for plastics sales, but in 1958 it far surpassed that of any other year. Sales dropped off rather sharply for most materials in November and December 1958 but nowhere near as precipitously as in 1957. January 1959 is thought to have been well ahead of January 1958 and better than November and December of 1958. However it was nowhere near equal to last October and not enough to create any particular enthusiasm. The rise was probably just enough to confirm the belief that business volume is on the way up, but not very far up.

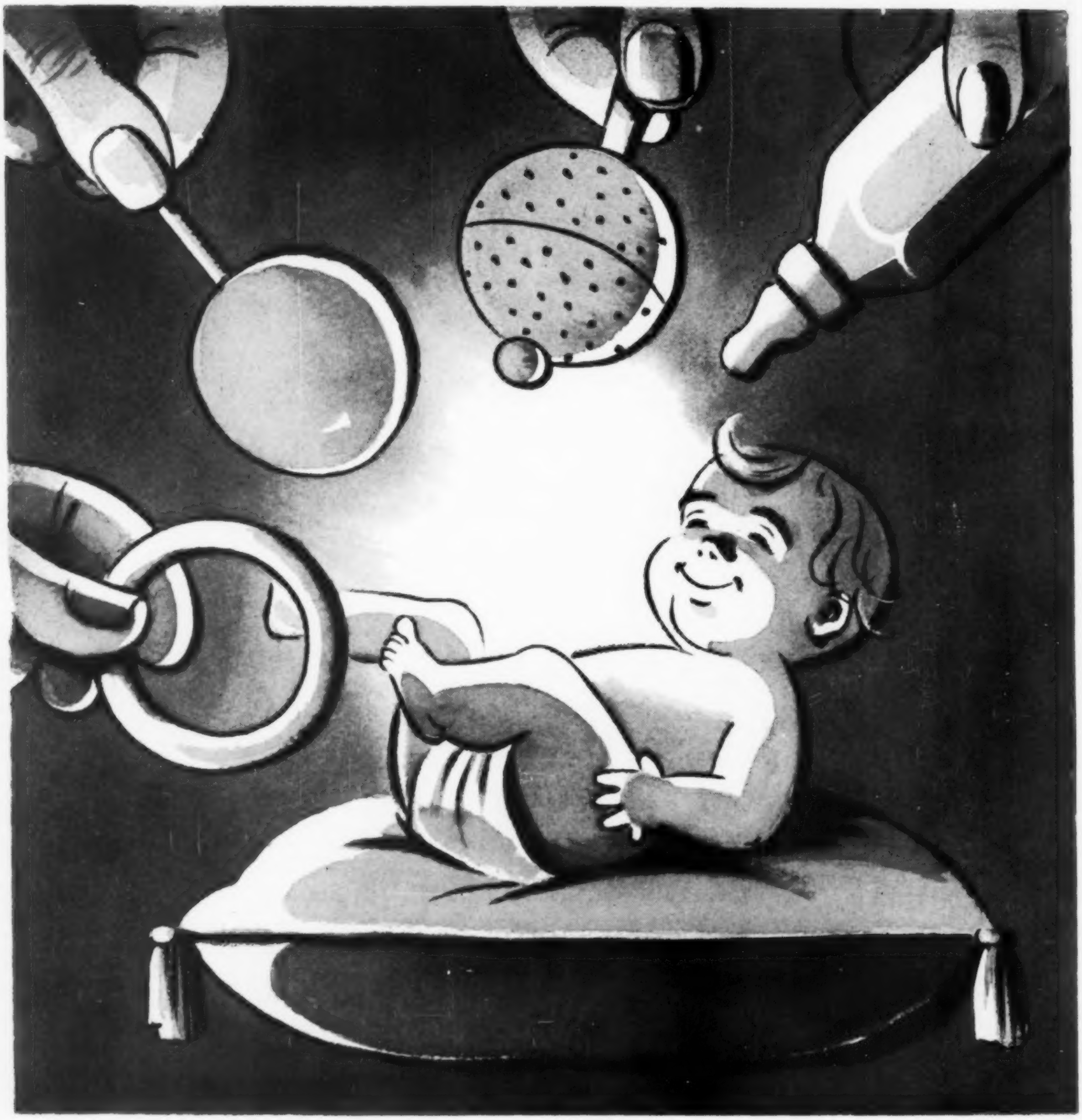
Profits, however, are on the decline; and this applies to plastics processors as well as materials producers. The margin between monomer and polymer continues to decline and overhead keeps climbing. The chemical industry reports that profits in the first three quarters of 1958 were 6.7% compared with 7.8% in 1957. An industrialist in another field puts it like this: "In 1958 it required 54% more sales and 70% more assets to produce income equal to that in 1950."

Vinyl chloride led the October upsurge. A tremendous 67 million lb. of PVC was the most sensational performance in resin sales last October. Polyethylene was larger, but it had been gaining steadily for months while vinyl had gone through a slump. That 67 million lb. was around 10 million lb. more than had ever been reported for vinyl in one month before. The industry started moving ahead in May of 1958, when volume passed that of 1957, and stayed ahead every month thereafter throughout the entire year.

The October 1958 figure was 10 million lb. ahead of October 1957 and the '57 figure was a record breaker up to then. But in 1957 sales dropped to 48 million lb. in November and to 40 in December. In 1958 they were around 58 and 52 million lb., which is better than any one of the first six months in 1958. Furthermore the increases in 1958 seem to have extended into every end use—a little greater in extrusions (wire coating in particular) and floor coverings but not enough to be solely responsible for the over-all upsurge. In 1957 the October increase was credited to over-buying of vinyl products by the automotive industry, which immediately cut back after customers refused to buy new models in the expected quantity.

Did lower prices raise vinyl volume? Some persons may claim that the extensive spurt in vinyls was partially due to the two price cuts in 1958 that brought PVC resin down to a 23½¢ base from a previous 27¢ rate. But there is no evidence to support this theory, since no new applications have come along that were simply "waiting for a lower-cost resin," and the last price reduction didn't come until December, and thus could not have had any effect. The increase in volume has come largely in markets where vinyl is already well established. The one notable exception is perhaps floor coverings where lower cost was essential. There are future projects, such as vinyl foam (20 million lb. in 1960) and rigid vinyl that should develop as a result of the lower resin price, but it is doubtful that volume increases in the second half of 1958 were much affected by price reductions for resin.

How much increase in 1959? In any case, sales man- *(To page 49)*



THE PLASTISCOPE

(Continued from page 47)

agers are mighty cautious in predicting sales growth for 1959—a 10% gain over 1958 seems to be their limit of optimism. That would be around 700 million lb. which is far below the industry's capacity of around a billion. There were times in 1958 when the industry produced at a rate of almost 900 million lb. a year and consumed at a rate of over 800 million; but this level of output and consumption was reached only for brief periods. Very few analysts are willing to predict when vinyl will reach the sought for billion-lb. figure.

PTFE-coated cable. A new idea in Teflon-covered cable for high-temperature electronic wiring is Multi-Tet by W. L. Gore & Associates, Newark, Del. This is a ribbon of side-by-side conductors, free of pinholes and accurately spaced for control of capacitance. Any combination of two colors can be used in the insulation, one on each side of the strip, to provide simple and positive identification of individual conductors. Strip widths up to 3 in., wire sizes from 34 to 16 AWG, and insulation thicknesses from 3 to over 30 mils are offered, to order. Coaxially shielded conductors can be included.

How these PTFE-coated ribbon cables are being made has still not been announced, but the makers have filed several process patent applications. Possibly the process is an improved version of the calendering process developed some years ago by Du Pont researchers (of whom Gore was one).

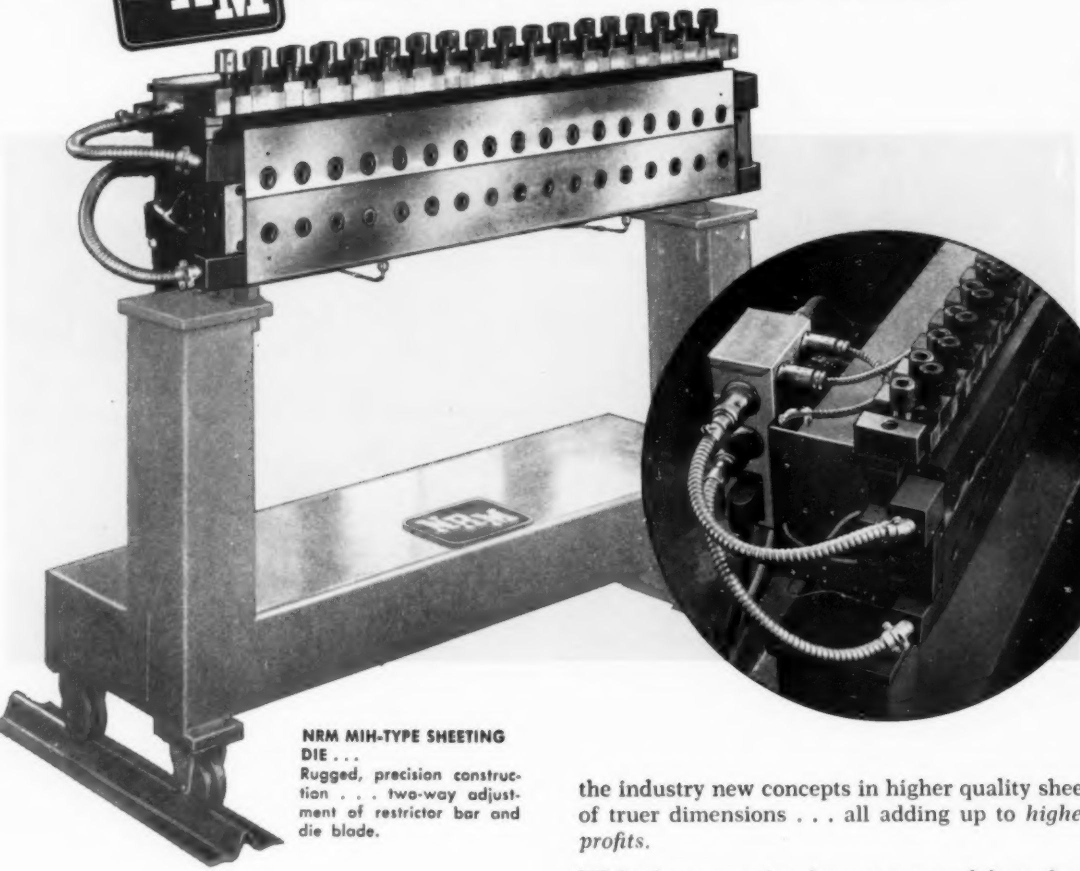
USI's portion of polyethylene. In a press review of National Distiller's annual statement the company chairman stated that the firm's chemical division, (USI) sold around 100 million lb. of polyethylene in 1958 and expects to sell at least 130 million in 1959. Total sales of all PE by United States producers in 1958 was between 820 and 830 million lb. USI is now the third largest PE producer in the world and will have 175 million lb. of capacity by March 1959. The company subsidiary, Kordite, a PE film producer, sold $18 million worth of goods in 1958 and is expected to sell $25 million worth in 1959 with the help of a new plant in California. The company's dibasic acid plant which will produce sebacic acid isomers has had various construction and manufacturing problems but is now close to commercial production.

Monsanto lowers the boom: Monsanto ushered in the New Year with a series of price reductions that really popped the cork out of the bottle. The firm reduced the price of polystyrene molding material by 2¾¢/lb.; the price of rubber grade styrene monomer was cut to 12¢ from a previous 12.7; DOP plasticizer was reduced from 28 to 25¢—and the plasticizer industry cried "Ouch" while the vinyl chloride industry said "Goody-goody"; other phthalate plasticizers were reduced 6 to 13%; phthalic anhydride, a base material for phthalate plasticizers, was reduced to 16½¢/lb., lowest price in the past 12 years. Like another company who announced a reduction in polyethylene "to meet competition" Monsanto can well say, "Amen." There will be more on this subject in this column next month.

For additional and more detailed news see Section 2, starting on p. 180

Extrude rigid and elastomeric PVC sheet

with NRM SHEETING DIES



NRM MIH-TYPE SHEETING DIE . . .
Rugged, precision construction . . . two-way adjustment of restrictor bar and die blade.

NRM Sheeting Dies are engineered, developed and provided with features that set *new highs* in ruggedness and precision of construction so vital to close-tolerance extrusion of thermoplastic sheet at high production rates.

They are designed specially for such materials as high impact Polystyrene, high density Polyethylene, Acrylics, Cellulose Acetate, Butyrate, and including both rigid and elastomeric *Polyvinyl Chlorides*. They use to the fullest, the high production capacities of NRM Extruders, and offer the industry new concepts in higher quality sheet of truer dimensions . . . all adding up to *higher profits*.

While the conventional gauge range of these sheet dies is for plastic sheet from .040″ to .200/.250″, the extreme ruggedness and precision of their construction permit gauges as thin as .008″ and as thick as .500″, under certain conditions. Up to 48″ trim widths are standard, larger widths available on request.

In considering dies for your sheet extrusion set-up, consider the long engineering background, the design advantages, and the great versatility of NRM Sheeting Dies and make yours NRM! A postcard brings you full engineering details and performance data.

2055-A

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wall thickness
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linear low-pressure polyethylene
® = Registered trade mark
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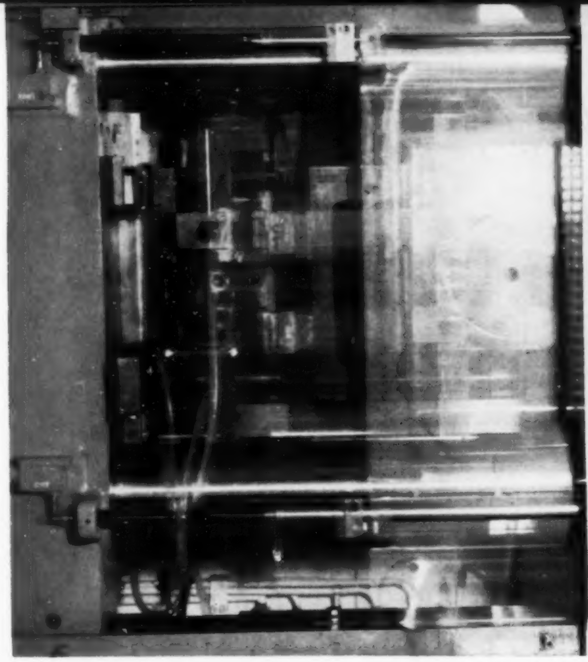
The articles above are made from HOSTALEN by our customers
Light and yet rigid . . .
Articles moulded from HOSTALEN have outstanding properties.
Its excellent rigidity and easy workability make possible the economic production of rigid injection-moulded articles possessing high gloss. Moreover, articles moulded from HOSTALEN are resistant to boiling water and numerous chemicals.
Why not try HOSTALEN GC 6400 or GD 6200 or any of its twelve coloured grades? Their ease of processing, their appeal, but, above all their economic use, will soon convince you.
FARBWERKE HOECHST AG. vormals Meister Lucius & Brüning FRANKFURT (M) - HOECHST / Germany

Short Moulding Cycles mean High Production



1/727

But the time required for each shot can only be shortened if the material behaves faultlessly in moulding and is always available in constant quality.

POLYSTYROL of BASF, which is supplied in various grades for all types of applications, has these properties — and many more, too: It has high mechanical strength, good shape retention and dimensional stability, a brilliant surface, excellent electrical properties, and high resistance to moisture, acids and alkalis. The material is available in a wide range of colours, and at very reasonable prices.

Our technical staff is always at your disposal to assist you with any advice you may require regarding the processing of POLYSTYROL. Literature describing the product will be gladly supplied on request.

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Other BASF products include

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- ® Ultramid *Polyamide*
- ® Luvican M 170 *Polyvinyl carbazole*
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- ® Styropor *Expandable polystyrene*
- ® Iporka *Expandable urea resin*
- ® Palatal P *Polyester cast resin*
- ® Oppanol B *Polyisobutylene*
- ® Oppanol C *Polyvinyl isobutyl ether*
- ® Acronal *Polyacrylate*
- ® Diofan *Polyvinylidene chloride*
- ® Lutofan *Polyvinyl chloride*
- ® Lutonal *Polyvinyl ether*
- ® Propiofan *Polyvinyl propionate*
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COLUMBIAN dispersed CARBON BLACK is designed for QUALITY... EFFICIENCY... PROFIT

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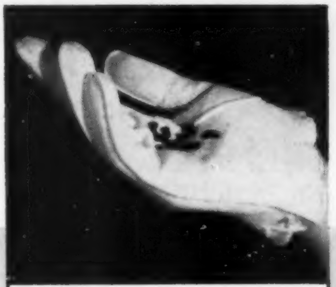

Short clean-up time ... no contamination of light colored stocks in production area ... increased mixing capacity (just blend them in).

All the advantages of Columbian dispersed black add up to a quality controlled product with less black ... with less work ... for more profit.

There's a Columbian black dispersion to meet your most exacting coatings, plastics or aqueous requirements ... to give you unsurpassed product quality ... efficiency ... profit.

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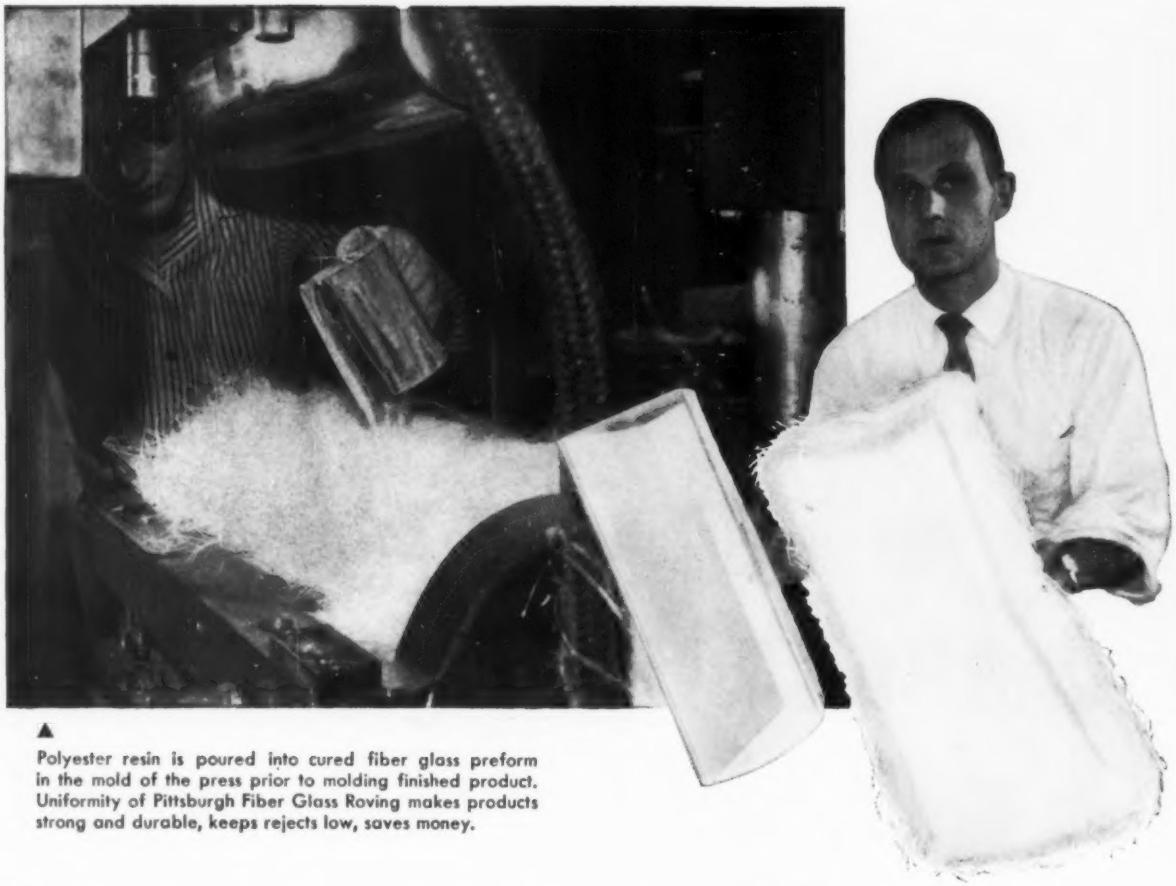

▲
Polyester resin is poured into cured fiber glass preform in the mold of the press prior to molding finished product. Uniformity of Pittsburgh Fiber Glass Roving makes products strong and durable, keeps rejects low, saves money.

"We cut rejections in half, produced better plastic products with Pittsburgh Fiber Glass Roving"

—says Mr. Robert E. Mollman, Production Manager, Plastic Products Corporation, Bedford Heights, Ohio

"The consistent uniformity we obtain from Pittsburgh Roving enables us to produce quality flower boxes, jardinieres, bird baths, mail boxes and laundry tubs that have fiber glass reinforcing through and through, especially at the corners," reports Mr. Mollman.

"When we began manufacturing three years ago, we tried a variety of fiber glass roving. Lack of roving uniformity from ball to ball caused a high rejection rate. But through this trial period, we discovered that Pittsburgh Type 610-60 Fiber Glass Roving produced more uniform preforms and permitted us to make strong and durable products. Using Pittsburgh Roving exclusively reduced our rejection rate very substantially.

"The dimension uniformity of Pittsburgh Roving is consistent from shipment to shipment. As a result, our operations are more profitable, we fulfill our obligations to customers and we make more efficient use of our materials."

HAVE YOU TRIED PITTSBURGH ROVING?

There's a type of Pittsburgh Fiber Glass Roving that's just right for your reinforced plastic operations. We'll be glad to help you get uniform results by working with you right in your own plant. For technical assistance, call your nearest PPG Sales Office, or write direct. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

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Manufacturers of plastics extruders, dies, take-offs, and other accessories

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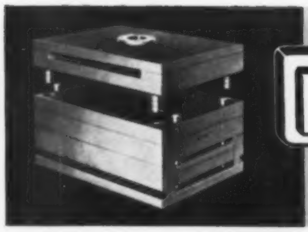
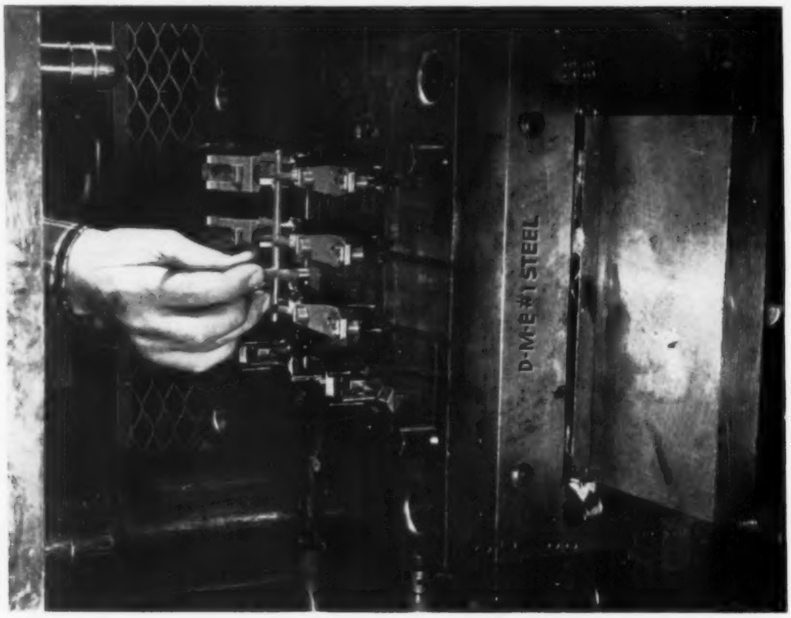


DME Mold Standards

DEDICATED TO QUALITY, SERVICE AND ECONOMY IN MOLDING



YOU SAVE MORE ON MOLD COSTS WITH OVER 6,000 D-M-E STANDARD MOLD BASES TO CHOOSE FROM

Largest Selection Saves You Time and Money

Whether it's a one-cavity "test" mold or a 60-cavity high production run, chances are D-M-E has the right size Standard Mold Base to fit the job and the molding machine.

D-M-E's 32 standard sizes, up to 23¾" x 35½", with 100 standard cavity plate combinations for each size, give you the largest selection of carbon or alloy steel standards available from any single source.

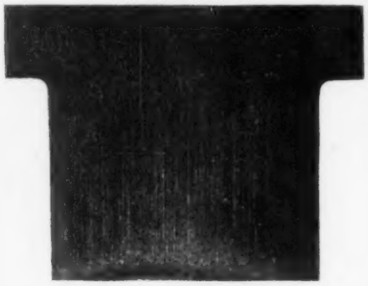
Save on Design Time, Moldmaking Time, Replacement Parts and Delivery

Design time is reduced by using D-M-E's full-scale Master Layouts and Catalog of specifications and prices. Moldmaking time is reduced because all D-M-E plates are precision ground flat-and-square, ready for cavity layout and machining. Exclusive interchangeability gives you the added saving of immediate replacement of any component part. And D-M-E's seven branch offices and warehouses are always fully stocked with Standard Mold Bases and components to meet your delivery requirements.

Cut Costs on Your Next Program

Start saving on your next moldmaking program, no matter how large or small. Take advantage of D-M-E Quality, Service and Economy.

Comparison Tests Prove Advantages of D-M-E Ejector Pins



This cross-sectional photo-micrograph of the hot-forged head on a D-M-E Standard Ejector Pin reveals superior grain flow.

Plastic mold or die cast die ejector pins amount to a fraction of total mold cost. But ejector pins affect mold performance more than any other single element. Recognizing the importance of ejector pin performance, D-M-E carries on continual research and development to provide the finest ejector pins to meet the combination of grueling thermal and mechanical stresses ejector pins must withstand.

Proof of Performance

Recent comparison tests by an impartial testing laboratory proved conclusively how D-M-E Standard Ejector Pins out-performed "higher-priced" pins in every test of the physical properties contributing to good mold performance—including tensile strength, surface and core hardness, surface finish and critical temperature of surface hardness.

Get All the Details

Ask your nearest D-M-E Branch for complete details of these comparison tests. And be sure to ask about the complete stock of every size of Standard Ejector Pins, including "Letter-size Diameters", available for immediate delivery.

FASTER DELIVERIES FROM COMPLETE STOCKS

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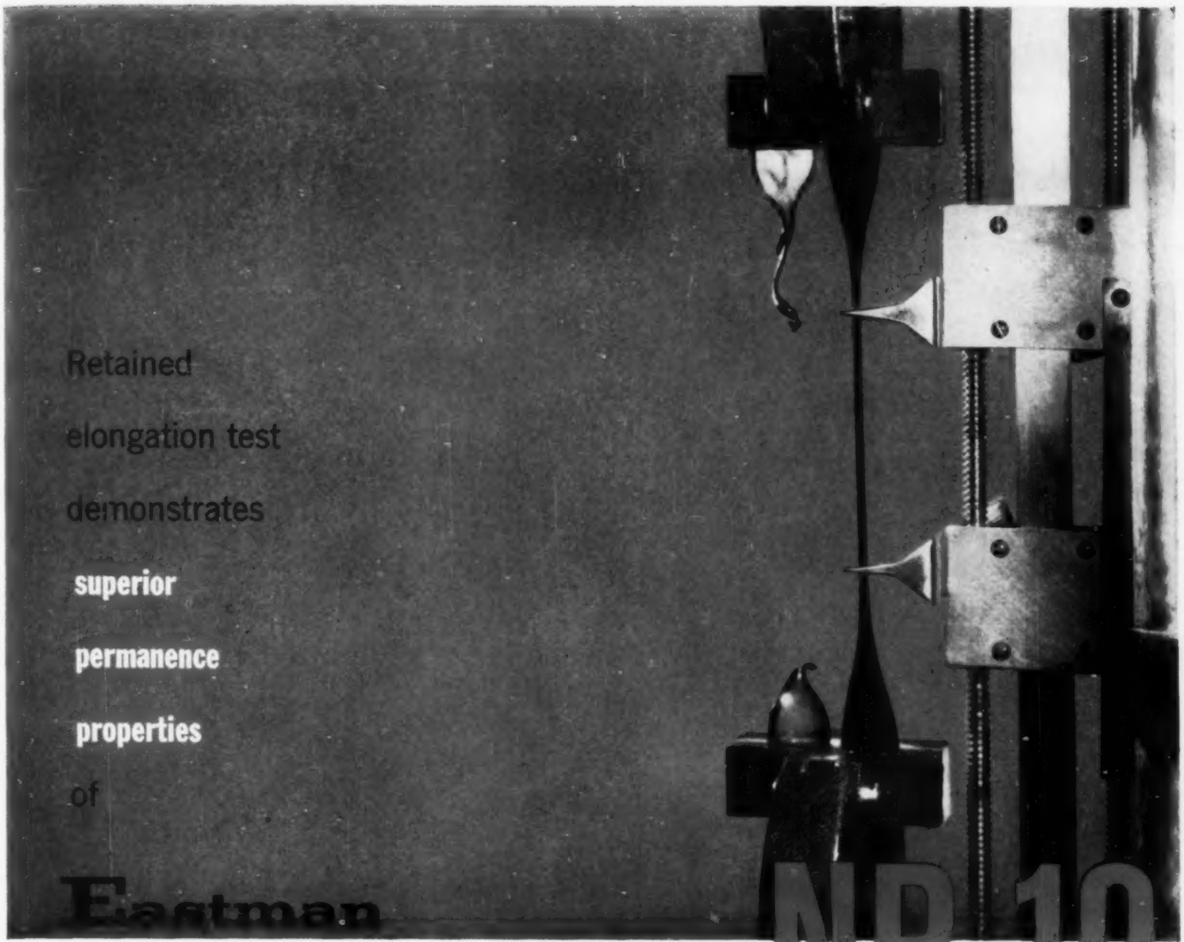

Eastman POLYMERIC PLASTICIZER NP-10

You are looking at a photograph of two vinyl test samples, both containing 50 parts of plasticizer per hundred parts of resin. The one at left is plasticized with DOP, the one at right with Eastman Polymeric Plasticizer NP-10.

To provide a basis for observing changes in physical properties due to heat aging, the ultimate elongation values of control samples containing these plasticizers were first established. Duplicate samples were then placed in an air-circulating oven for seven days at 120°C. After heat aging, the samples were placed in a tensile machine and their retained elongation determined.

The DOP plasticized vinyl sample retained only 75% of its initial elongation. The NP-10 plasticized sample, on the other hand, was unaffected by aging at elevated temperatures, exhibiting a retained elongation of 100%.

Providing long term plasticity at elevated temperatures is only one of NP-10's excellent permanence characteristics. This primary polymeric plasticizer is highly resistant to hydrolysis. Its loss from vinyl films to hydrocarbons, soapy water and activated charcoal is extremely low.

NP-10 exhibits permanence properties equal or superior to those of higher molecular weight plasticizers, yet it is a compound of relatively low molecular weight. As a result, NP-10 blends easily and rapidly, permitting vinyl compounders to obtain maximum permanence characteristics while maintaining efficient production schedules.

As a vinyl plasticizer, Polymeric Plasticizer NP-10 shows little tendency to migrate to other materials. Its effect on easily-crazed surfaces such as polystyrene is extremely low. NP-10 is colorless and provides good low temperature flexibility.

If you are looking for an ideal primary plasticizer, one that combines maximum permanence with ease of processing, investigate Eastman Polymeric Plasticizer NP-10. Write to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

SALES OFFICES:
Eastman Chemical Products, Inc.,
Kingsport, Tennessee;
New York City; Framingham, Massachusetts;
Cincinnati; Cleveland; Chicago;
Houston; St. Louis.

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San Francisco;
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Salt Lake City; Seattle.

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and expanded product lines,

Swedlow Plastics Company

announces a change in name to...

SWEDLOW Inc.

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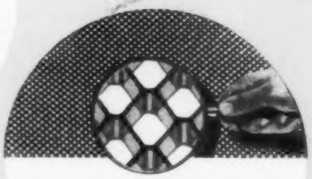
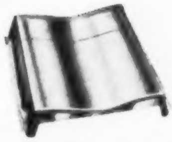
STRETCHED AND MONOLITHIC PLASTIC GLAZING for aircraft windows and enclosures. Optically polished, tough, light weight.

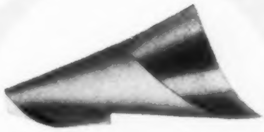


HIGH TEMPERATURE WELDED AND ALUMINUM HONEYCOMB CORE. For aircraft and missiles. Heat resistant, light strong.

GOLD AND ALUMINUM METALIZED PLASTIC LAMINATES. Minimum weight, minimum bulk, heat protection to 1650° F.



HIGH TEMPERATURE REINFORCED PLASTIC LAMINATES for sheeting and contoured parts in missiles and aircraft.



PRIMARY SOURCE FOR CONTINUOUS AND PRESS MADE LAMINATES for aircraft and industrial uses—fibre glass, cotton, nylon, etc.

KEVINITE FLEXIBLE, DECORATIVE LAMINATE. An all-paper, polyester, continuous laminate, available in many color and design combinations.

Swedlow has long been well known as a leader in the development and fabrication of high quality Plastic Glazing for aircraft. Excellence in this field has resulted in demands for the same type of development and craftsmanship in additional products of fine quality, involving metals and many other materials.

High temperature Welded Honeycomb Core in stainless steel and super alloys has become a very important part of our business, along with Aluminum Honeycomb Core, and the volume of these light weight, strong structural materials is growing rapidly to meet the increasing needs of aircraft, missile and other industries.

Swedlow products also include a wide variety of high heat-resistant reinforced plastics, utilizing fibre glass with silicone, phenolic and epoxy binders and metalized for extra heat protection.

This diversification and expansion makes the change to a more inclusive name desirable. In all of its products, the company will continue to adhere to the highest standards of quality and workmanship in the future.

SWEDLOW Inc.

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"Start to Finish" Service

...It can mean a great deal to You!

Product design • Material choice
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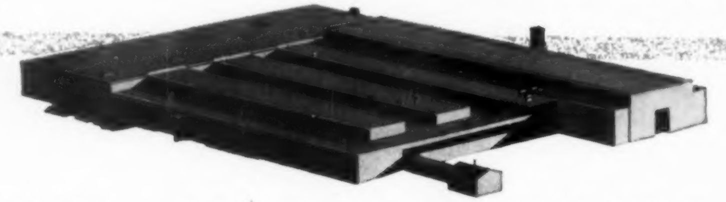
Let us help you work out your problems from "Start to Finish" with the fully co-ordinated facilities of our modern factory.



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- In calendering, Thermolite 112 gives clear films without any plate out on the rolls. Vinyl compounds with sensitive pigments will not drift in tone during calendering.
- Extrusions run longer and clearer without plate out on dies, therefore, no expensive machinery down time—**a plus factor** with Thermolite 112 stabilizers.
- In plastisols, Thermolite 112 with Thermolite 166 gives a powerful heat and light stabilizer combination with excellent viscosity characteristics and good air release.
- Also available are two auxiliary stabilizers which may further improve your plastic products: Thermolite 180, a purely organic stabilizer and powerful antioxidant, and Thermolite 166, a liquid zinc stabilizer.

For information on these or other Thermolite Vinyl stabilizers, write Metal & Thermit Corp., Rahway, N. J.

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the highest quality you can get in any quantity you can use!

The highest-quality, volume-production Cyclohexanone offered . . . that's still the seven word story of NADONE. *Minimum* purity is now 99.7% but individual shipments regularly better this high standard.

Our Hopewell, Va. plant employs an advanced direct continuous process developed by National Aniline research. It is integrated back to basic raw materials within the Allied Chemical group and well located to serve the resin, plastics, coatings and chemical industries. Drum stocks also available in principal cities.

Have you investigated the benefits of using this high-power solvent to improve your solvent system? In terms of its performance ability, it is attractively priced for many specialized uses.

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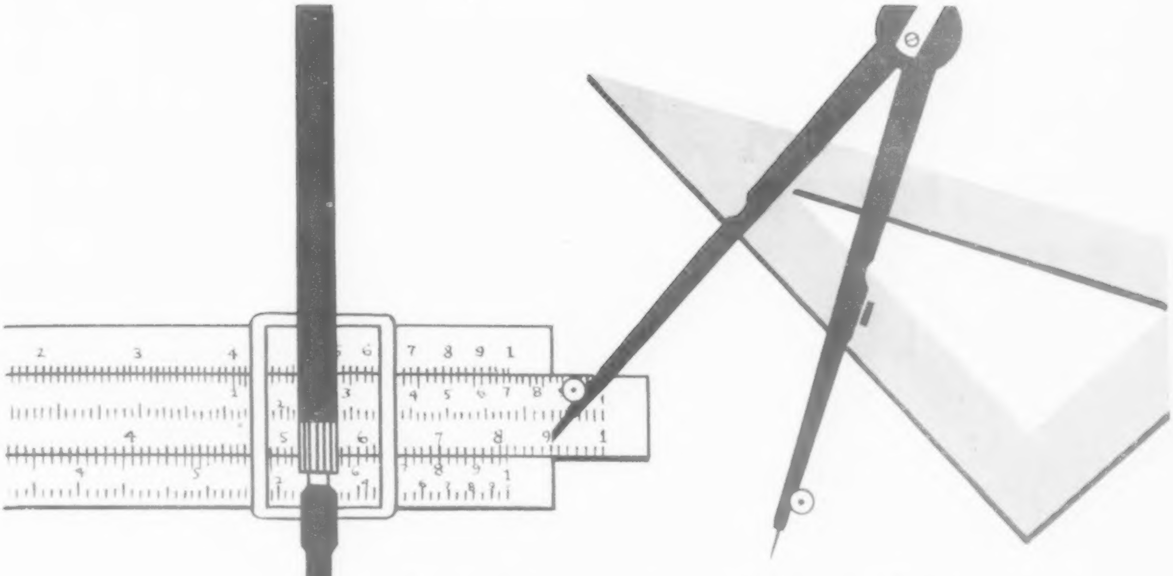
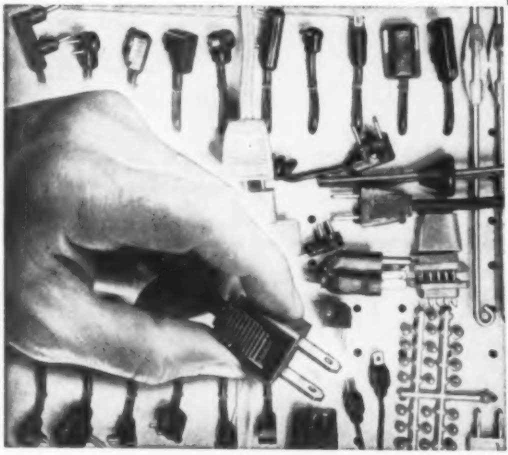


MOLD THEM QUICKER BETTER FOR LESS

on . . .



MINI-JECTOR cuts costs for manufacturers of electrical, electronics, industrial, and commercial equipment. Wide variety (above right), MINI-JECTOR produced, represents major savings in big-press tooling where not required. Electrical and electronics parts (above) made for less on MINI-JECTOR: plugs, cord-ends, antennas, miniature brush ass'ys, slip rings, etc.

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PLASTIC INJECTION MOLDING MACHINES

Quicker: Produce thousands of molded items often before big-press tooling is off design board.

Better: Award-winning quality and precision even in complex, insert molded designs.

For Less: Develop and produce molded items at fraction of big-press tooling costs.

You can save actual thousands in mold costs alone with MINI-JECTOR! (Moldblanks as low as $29.50.) Others are doing it—avoiding big-press "high-per-piece" tooling expense where not required.

Only MINI-JECTOR offers so many exclusive features:

. . . for quicker, lower-cost development and steady, moderate production of variety of small (up to 1½ oz.) plastic items in all thermoplastics, including Nylon.

. . . for quick design changes; and running thousands of perfect market-test samples.

. . . for specialty items and plastic molding over inserts—from intricate electronic parts to baits, novelties, etc.; marketed quicker.

. . . for laboratory and educational test-sample design and production—quick thousands of perfect parts in variety of colors. No lost changeover time.

. . . for short or moderate runs—too costly on big-presses—profitable on MINI-JECTOR.

Send for FREE Catalog—Detailed, illustrated, complete. Engineering data and specifications on entire low-cost MINI-JECTOR line of plastic injection molding machines and accessories. Many features superior to most expensive machines. Shows how MINI-JECTOR helps you develop and produce (up to 1½ oz.) molded plastic items more profitably than by other methods.

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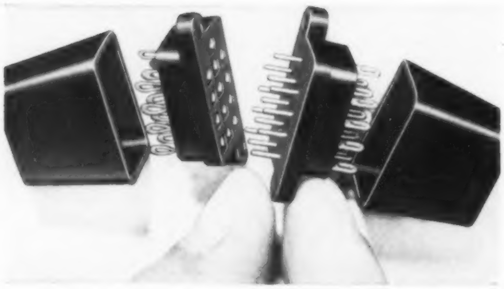

Among the thousands of precision parts made on MINI-JECTORS are these sub-miniature plugs. The producer reports a savings of over $4,000 on mold costs alone for this part.

Model 70VC95 "Eldorado"
vertical clamping—ideal for inserts, loose cores.

Model 45 "Wasp" (bench)
low cost molding.

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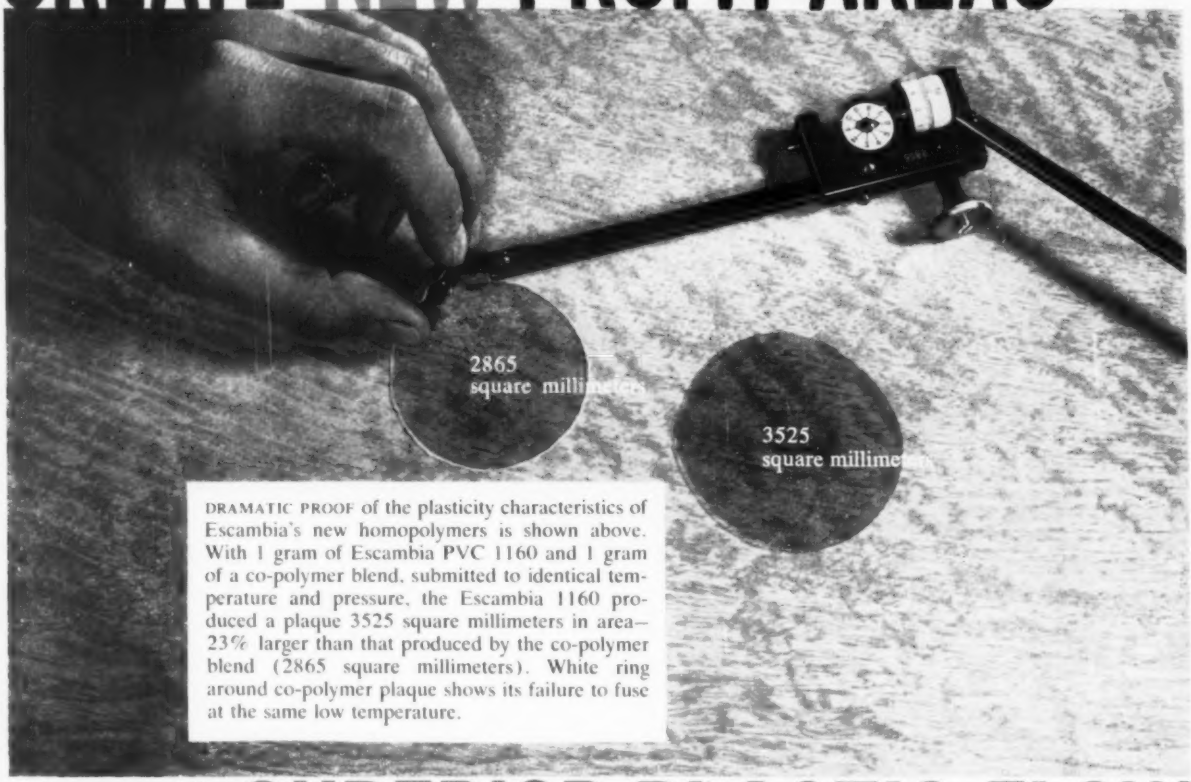

DRAMATIC PROOF of the plasticity characteristics of Escambia's new homopolymers is shown above. With 1 gram of Escambia PVC 1160 and 1 gram of a co-polymer blend, submitted to identical temperature and pressure, the Escambia 1160 produced a plaque 3525 square millimeters in area—23% larger than that produced by the co-polymer blend (2865 square millimeters). White ring around co-polymer plaque shows its failure to fuse at the same low temperature.

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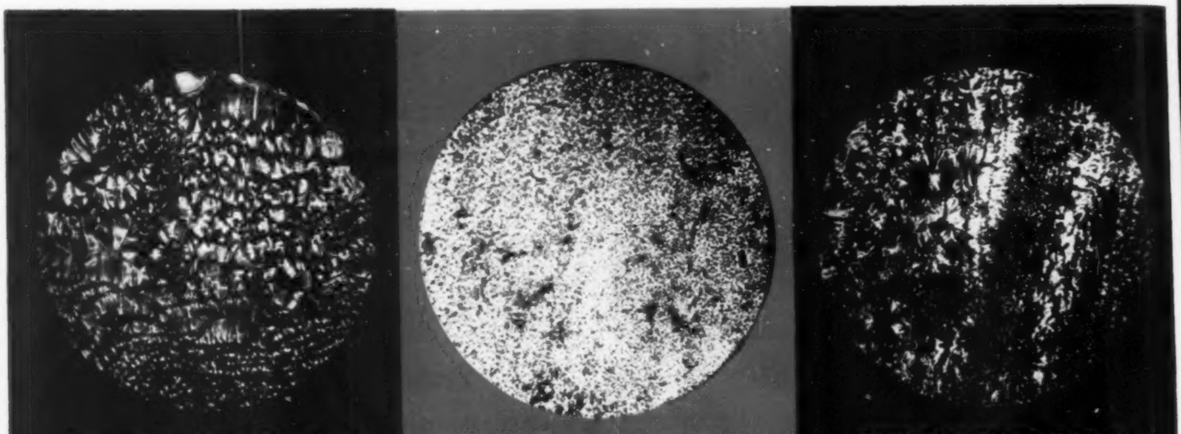

Conventional type 66 nylon magnified 400 times — Modified Fosta Nylon 62 ASK magnified 400 times — Conventional type 6 nylon magnified 400 times

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February 1959, Volume 36, Number 6

MODERN PLASTICS

FINAL RESULT. Finished RP cover is attached to outboard motor. Mass-production techniques developed in making these covers are expected to have strong effect on RP molding industry.

New mass-production plant for RP molding

Many innovations in plant layout, materials control, testing, molding, and finishing are features of brand-new Outboard Marine facility geared to produce 1800 motor covers per day

When Outboard Marine Corp., Waukegan, Ill., recently announced its 1959 line of Johnson and Evinrude outboard motors, the news was greeted with interest not only by boating enthusiasts, but by the reinforced plastics industry as well. And the reason for this interest was simple. The nation's foremost producer of outboard motors had switched from die-cast aluminum to fibrous-glass reinforced polyester motor covers.

In this switch, the company not only broadened the base of a vast new market for rein-

RESIN PREPARATION. Ingredients of resin mix are combined in high-speed shear-type mixer. Polyester is pumped to mixing room from outside tanks, cannot be contaminated enroute.

forced plastics (over 600,000 outboard motors are sold annually in the United States); it also established new production processes which, in terms of automation and efficiency, may easily become models for manufacturers of other products.

Why the switch was made

Principal advantages of the reinforced plastic covers, as summarized by Outboard Marine, include significant cost savings and shorter delivery time on production dies, plus the fact that the new shrouds won't corrode, resist denting and abrasion, have high impact resistance, and are somewhat lighter in weight than the previous metal covers. Weight saving on the cover for a 50-hp. motor is approximately 3 pounds. Reduction of motor noise is another plus factor.

Production of the reinforced plastic components is centralized at Outboard's Gale Products Div. plant in Galesburg, Ill., where a complete reinforced plastic molding department was installed to implement the new program. Among the outstanding features of this plant installation are conveyorized handling of preforms and molded covers; a piping installation which carries the catalyzed polyester resin directly to each molding press where it is dispensed in accurately controlled volume through metering nozzles, and the use of highly automated multiple drilling equipment, used in conjunction with refrigerated combination holding and shrink fixtures.

Ten separate sizes

Included in Outboard Marine's comprehensive reinforced plastic program are 10 separate sizes and types of covers, embracing Johnson and Evinrude motors in 5½-, 10-, 18-, 35- and 50-hp. models. The Galesburg installation, which includes three automatic preforming machines, eight compression presses, multiple drilling units, and miscellaneous equipment used in finishing the covers preparatory to painting, is geared for a maximum output of 1800 units per day. All of the final painting and attachment of metal trim parts are handled by Johnson Motors, Waukegan, Ill., and Evinrude Motors, Milwaukee, Wis., in their respective plants.

Although reinforced plastic motor shrouds have been known for some time, Outboard Marine refused to settle for less than the shiny, automotive-type finish which has characterized its aluminum covers in the past. Accordingly, as the company's development program progressed, special attention was given to attainment of a smooth finish which would get away from the fibrous surface often associated with reinforced plastic parts. Under direction of the OMC manufacturing research department, and with the assistance of Owens-Corning Fiberglas Corp., many previously untried techniques, as well as some that were already proved and in use, were tested.

Experiments with veil mats showed that these materials helped to suppress the fiber pattern. Additionally, investigation turned to a process of prime coating, baking, sanding and finish painting. With the aid of Pittsburgh Plate Glass Co. and Rinshed-Mason Co., a satisfactory surface primer and finish paint were developed.

How do costs compare?

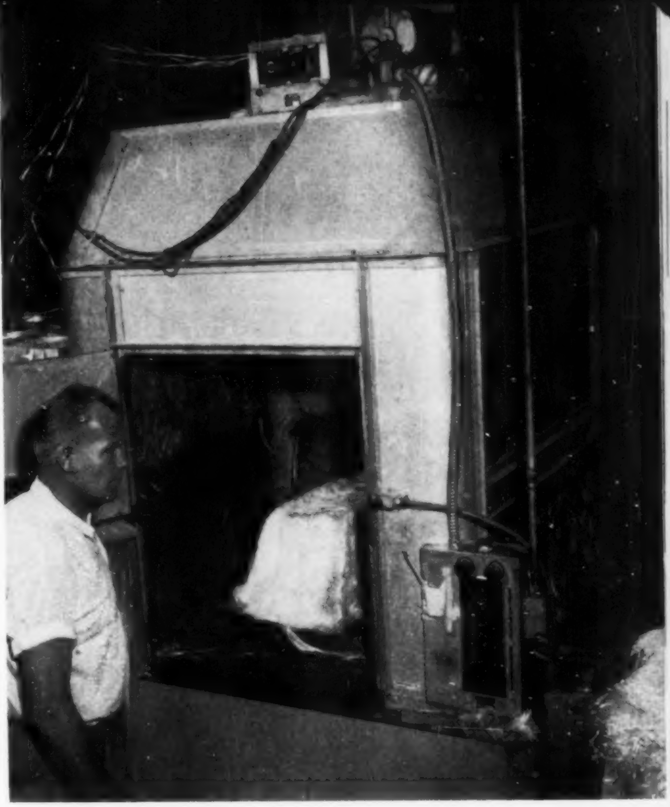
With reference to comparative costs of the reinforced plastics covers and the metal covers which they replace, Outboard Marine states that on a typical shroud—that used for the Evinrude 35-hp. motor—there is a saving of approximately 15% on the plastic unit. This cost reduction reflects such factors as elimination of die cast trimming and felt polishing before

painting, required with the metal covers, permitting the use of less capital equipment.

Whereas the die-cast aluminum shrouds were made in two halves, hinged at the top to facilitate removal from the motor, the new reinforced plastic hoods are of the one-piece, lift-off type and feature a crisp new design treatment. They mount to the aluminum lower cover section by means of ingenious, quick-action clips. The covers seat into a heavy rubber gasket which seals the junction against entrance of water spray and helps to muffle motor sound.

Plant layout

Key to the efficiency of the reinforced plastic molding setup at Galesburg is the carefully engineered layout of preforming machines, molding presses, multiple drilling units, and finishing operations, closely integrated by overhead conveyors which minimize handling of



PREFORMING OPERATION. Finished preform in plenum chamber in photo above is ready for removal from perforated mandrel. In photo below is conveyor from preform room which supplies presses and also serves as preform storage area. Drying oven, at upper right in photo, removes moisture from preforms. Pallets on conveyor system can store approximately 2000 preforms.

DISPENSING THE RESIN. Specially designed nozzle system, fed directly from the mixing room, spreads resin in set pattern over preform. Operator controls flow with his right hand.

END OF MOLDING CYCLE. Press operator strips off trimmed flash before removing motor shroud from press. Punch is in raised position. Total molding cycle is approximately 2½ minutes.

DRILLING THE SHROUD. Multiple drilling machine (left) beside each press simultaneously drills all required holes in the motor cover. Machine is run by molding press operator, who is shown here positioning veil mat on preform preparatory to starting another molding cycle.

preforms and molded parts. One conveyor also provides "floating storage" for the preforms prior to molding.

Polyester resin (Hetron 32A), which is purchased in tank-truck volume, is pumped into two 5000-gal. tanks located outside the plant for convenient access. Tanks are equipped for both heating and cooling to compensate for the effects of outside temperature on the stored resin. From these tanks, the resin is piped directly to a special mixing room. After mixing, it is pumped into a holding tank, where a vacuum is drawn to extract any air bubbles present which might produce imperfections in the molded parts. Prior to the actual use on production parts, a flat test panel is molded with a sample from each tank of resin and carefully checked before the resin is released for use on the production line.

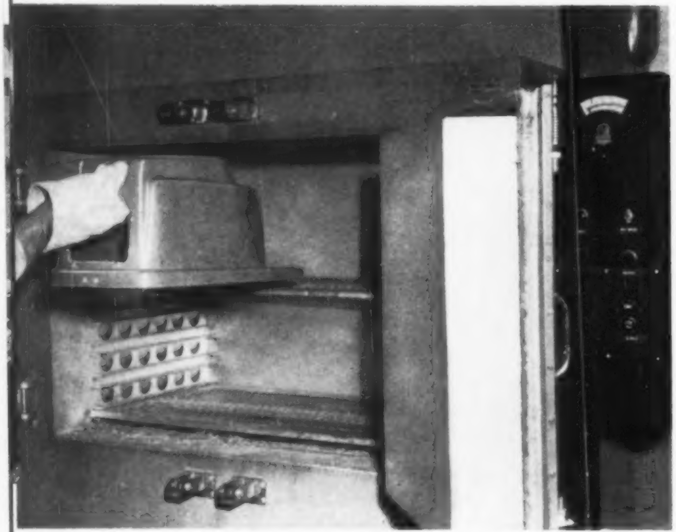
From the holding tank, the polyester resin flows via stainless steel pipelines directly to the molding presses. Provision is made for the cooling of the lines, if that is necessary, to eliminate any possibility that the resin may begin to set up prematurely and block the lines.

Three automatic preforming machines—two with 30-in. plenum chambers and one having a 26-in. chamber—produce the preforms for the various covers. Continuous strands of Owens-Corning fibrous glass roving, feeding into these units, are chopped into short fibers and drawn by vacuum onto perforated mandrels having the approximate dimensions and contours of the finished covers. Binder resin, sprayed automatically onto the preforms, is initially set by heat before each preform is removed from the machines. Preformers were supplied by I. G. Brenner Co., Newark, Ohio.

Upon removal from the automatic preformers, the preforms are hung on an overhead conveyor which carries them past a bank of infrared lamps to insure the removal of all moisture before they reach the molding presses.

An outstanding feature of the Galesburg installation is the method used to impregnate preforms prior to molding. Carried directly to the presses by the pipeline system, the resin is metered in precise quantity through specially designed nozzles which distribute it over the preform in a pre-determined pattern. The interchangeable resin nozzles are "tailored" to each size and type of preform. Resin distribution, controlled by a push-button arrangement, is based on a positive displacement system, insuring accurate volume from shot to shot. This system eliminates all manual pouring and meas-

FINISHING. At sanding table, flash is removed from around window openings and bottoms of covers. Sanding dust is drawn through screen in top of table (holes are too small to be visible in photo) and removed through ducts.



QUALITY CONTROL. In one of several tests made during production of covers, forced-air electric oven is used to simulate conditions in actual production painting operation . . .

. . . In another, muffle furnace is used to check binder content of a sample of glass mat cut from a preform. Same oven is used to determine glass-resin ratio of molded parts. All tests are conducted in Outboard Marine control laboratory.

uring of resin, with its attendant chances for error.

The HPM compression presses on which the covers are molded have 84 in. of daylight and a 48-in. stroke. Six of them are of 100-ton capacity; the other two are 150-ton units. Semiautomatic in operation, the presses have a closing speed of 425 in. per minute and an intermediate slowdown before the punch hits the cavity. At the end of the molding cycle, which runs approximately 2½ min., they begin with a slow breakaway to avoid cracking the part, then move into a fast opening speed of 149 in. per minute. High breakaway tonnage is 23 tons on the 100-ton presses and 37 tons on the 150-ton units.

Presses are paired off in groups so that one operator can handle two presses. Beside each press is a specially designed multiple drilling fixture on which side cores are automatically drilled in the covers immediately upon removal from the press. Cooled by circulating refrigerated air, the drilling fixture also serves as a shrink fixture, rapidly removing heat from the molded part during the drilling operation to guard against warpage and insure accurate dimensions in the finished covers. During cool weather, the 10-ton refrigeration unit is bypassed and outside air is pumped into the shrink fixture. After drilling, the covers are hung on another conveyor line which carries them to the finishing table.

Minor finishing required

The finishing operation on the covers includes edge routing, removal of flash, and belt sanding operations performed at a long table equipped with a screened top through which removed material is drawn by negative pressure. Any small imperfections in the covers are patched by an operator at this table, who uses a small oven to cure any patch before it is sanded to smooth finish.

This completes operations on the covers at the Galesburg plant. The finished covers, ready for painting and trimming, are placed on specially designed pallets for transport by truck to the Johnson Motors and Evinrude Motors plants. Here the covers are prime coated and painted with the finishes mentioned earlier, using different identifying colors for the two separate lines of motors. Two baking operations at a temperature of 240° F. impart the durable, automobile-quality finish which distinguishes the new Outboard Marine reinforced plastic covers.—END

RECLINING CHAIR, shown in close-up at left and circled in complete set-up of miniature beauty salon above, is an accurately scaled replica of a standard type chair used in professional beauty shops. Realism of design is followed even to the extent that the foot-rest raises as the back is tilted.

Plastics for "big-ticket" toy

Realistically molded toy beauty salon is designed around high-density polyethylene

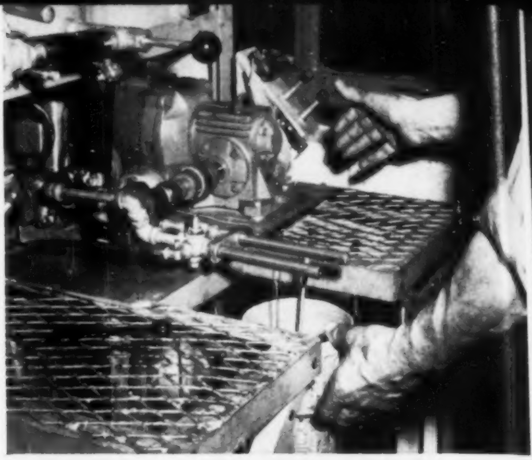
Adaptability to the miniature realism that delights the hearts of modern-day sophisticated youngsters and an inherent toughness that backs up the use of the "unbreakable" label are combining to push some of the newer plastics materials into a relatively untapped area of the toy field—the "big-ticket" items that sell for anywhere from $8 to $10. Along these lines, Denis Crib, Inc., Holyoke, Mass., has introduced a toy miniature beauty salon molded almost entirely of high-density polyethylene and retailing for the healthy price of $8. The sales response to the plastic toy has already proved strong and the manufacturers are hoping to cut into a large share of the lucrative "little girl" market that avidly buys up clothing, miniature cosmetics kits, and miniature home permanent kits as accessories for the 40-million-high fashion dolls that are sold annually.

Taking advantage of the design potential of high-density polyethylene, the toy, which is known as the Breck Beauty Salon, is composed of seven polyethylene pieces—a chair with hair dryer, reclining chair, sink, planter, two cabinets with sliding door, and hamper—each molded as an exact miniature scale counterpart. In addition to its toughness, the high-density polyethylene offers just the right degree of structural rigidity essential to the design of many of the parts.

The sets are available in pastel blue or white. They are molded of Phillips Marlex resin by Eastern Plastics Co., N. Wilbraham, Mass., in a six-family mold with 22 cavities.

With the basic beauty salon parts, the little girl gets everything she needs to set up shop. The package of accessories included with the set offers a styrene brush, comb, and hand mirror, a vinyl apron for the doll being groomed, and four soft polyethylene hair curlers.—END

COPPER SHELL is brushed with priming solution preparatory to pouring the resin. Dam around edges, made of vinyl strips held in position with tape, will retain resin during cure.



PROPORTIONING MACHINE dispenses resin-hardener mixture to container in exact amount required for plate to be backed.

Epoxy-backed printing plates

The illustrations, both color and black and white, appearing with this article, as well as the copy you are now reading, were printed from electrotypes backed with epoxy resin, rather than the conventionally used lead-alloy material. This is the first time in the history of business journalism that such plates have been used in a regular run of a publication. Principal advantage of the new plates is that they make possible weight reductions of up to 70% in the finished electrotypes, resulting in significant savings in handling costs.

In a development that holds promise of contributing significant savings to the handling of electrotypes, Printing Plates Research, Inc., Toledo, Ohio, has introduced to the printing industry epoxy-backed electros. Suitable for all types of letter press printing (flatbed and rotary) the epoxy-backed plates weigh 60 to 70% less than conventional metal-backed types. All of the illustrations accompanying this article were printed from the new electrotypes.

The new printing plate, called Electroplastic, consists of a copper printing shell half the thickness of a standard electrotype shell, to which is cast a backing of Epon epoxy resin. The resin is supplied by Shell Chemical Corp. The actual casting is done by local electrotypers operating under licenses from Printing Plates Research.

The major weight reductions made possible by the use of epoxy can add up to important savings in transportation costs, since electros are often shipped long distances. In the 7 by 10 in. mounted plate size (the size of a standard full-page ad in this magazine), the Electroplastic plate weighs 1 lb. 14 oz., compared with over 5 lb. for an ordinary lead-alloy electro. Via 4th class mail, shipping costs on the epoxy plate would be 37% less than on the 5 lb. plate. By air mail, which often has to be used to meet publication deadlines, savings could amount to 67 percent.

Cost of the plastics electros themselves is at present comparable to the cost of conventional plates. Electros made for this article by Cresset Co., New York, N. Y., were priced the same as standard types. As reported by Shell, thousands of the epoxy-backed plates have been used successfully during the past two years.

The epoxy plates also reduce finishing operations because the cast plate is level, with a faithfully reproduced printing surface. Lead electros often have to be pounded to flatten out frontal areas. This involves considerable skilled labor and still often results in impaired

RESIN MIXTURE is poured onto copper plate, which rests on vacuum table that keeps plate flat. Resin is then cured under infra-red heating units.

VINYL MOLD is stripped from face of copper shell after epoxy backing has cured. Finished plate is then shaved to exact thickness.

half tones and type. The flattening operation is necessary because, when the hot lead is poured against the thin copper face, the copper expands, pulling the plate out of shape.

According to Technical Advisors, Inc., consultants to Printing Plates Research, durability of the epoxy plates is excellent. Curved Electroplastic plates are reported to have made runs of close to 2 million impressions without showing appreciable wear.

How they are made

The first steps in producing a plastics electrotype (making the copper shell) are similar to those used for a conventional plate: vinyl molds are sensitized, silvered and plated with copper. However, since only half the conventional thickness of copper shell is required, plating time, amount of copper, and electricity needed are all reduced to half.

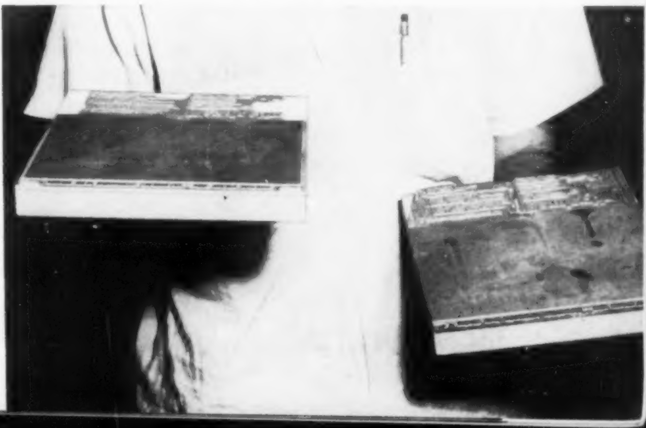
In making the epoxy backing, the first step is to build up a shallow dam on top of the copper shell to retain the resin. This is done with vinyl strips taped in place. The shell is then primed and placed on a vacuum table to hold the plate flat. Since the amount of epoxy used per sq. in. of plate area is important, an automatic resin-catalyst dispensing machine is used to measure out the exact charge. The liquid resin-hardener mixture is then poured into the copper shell, which serves as a casting tray. The epoxy is cured under thermostatically controlled infrared lamps. Curing time is 40 minutes or slightly longer, depending on the size of the plate being made. During this time, of course, the operator is free to work on additional plates.

When the epoxy has cured, the original vinyl mold is easily stripped from the plate. Since the shell is backed up before the mold is stripped, there is no danger of distortion and warpage of the shell common in conventional techniques. After the plate has been shaved on a rotary blade shaver, it is mounted to a wood block or metal base with an adhesive. Then the Electroplastic plate is ready for printing.

Sizable market anticipated

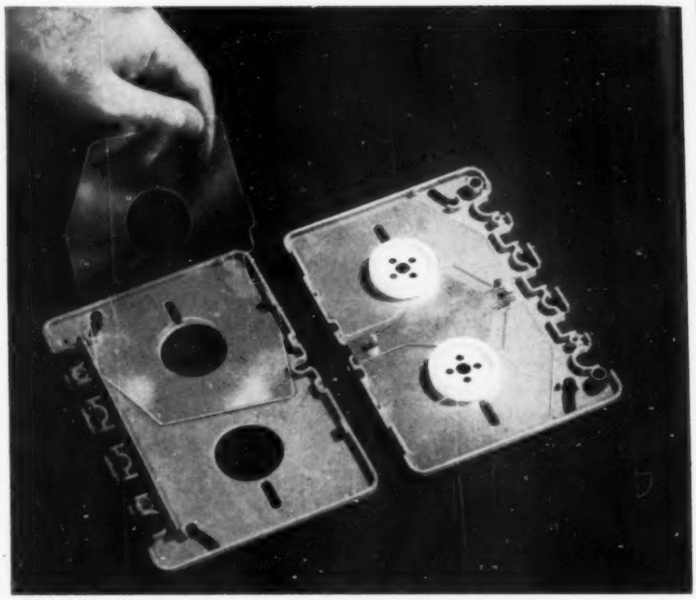
Widespread acceptance of the new plates will to a large extent depend on the reaction of printers, whose experience with them to date has been somewhat limited. Shell spokesmen state that such operations as notching, routing, and mortising present no problems. Our own printer has found nothing unusual in printing from these plates. However, until printers are fully familiar with these new types of electros, their acceptance will be limited. Once such education has been accomplished, plastics-backed electros will represent a sizable market for the epoxy industry.—END

DRASTIC weight reduction is possible with epoxy-backed printing plate. Conventional lead-backed electro at right weighs over 5 lb.; Electroplastic plate at left weighs only 1 lb., 14 ounces. Both are mounted on wood blocks.



NEW CONCEPT

COMPACT new molded cartridge for magnetic tape recording measures only 5 in. wide, slightly more than 7 in. long, and ½ in. thick. It holds 560 ft. of tape, which is fastened to two inner hubs and passes across open slots at the front edge of the cartridge where the magnetic recording and reproducing action takes place.



OPEN VIEW of the two mating halves of the cartridge, showing inner hubs and spring-loaded metal brake in center of part at right. Die-cut pieces of polyester film serve as anti-friction liners in both sides of the case.

Cartridges that are expected to bring to the magnetic sound tape field the handling convenience of phonograph records—and thus vastly increased acceptance—owe their development largely to ingenious design in general-purpose polystyrene. The economy, light weight, integral color, and design latitude inherent in the material made it the choice for this application.

The new cartridge, which does away with all threading and rewinding operations, measures 7³⁄₁₆ by 5 by ½ in. and holds 560 ft. of 1-mil acetate tape accommodating four sound tracks.

Development of the unit was spearheaded by RCA. Parts for the RCA cartridge are injection molded by Santay Corp., Chicago, Ill., using Dow Styron 666 general-purpose material. In addition, Minnesota Mining & Mfg. Co., St. Paul, Minn., and American Molded Products Co., Chicago, Ill., are producing similar molded cartridges which have the same external dimensions. Other companies are also reported to be tooling up for the production of tape cartridges. All cartridges made today are compatible with a specially designed RCA recorder on which they are played.

Construction details

Essentially, the cartridge consists of two molded styrene hubs, slightly more than 1½ in. in diameter, enclosed in a molded styrene housing. Magnetic tape is threaded onto both hubs before the case is assembled. When the cartridge is positioned on the recorder, a brake locking both hubs against rotation is automatically released, allowing the tape to unwind from one hub, pass through the recording and playback head, and wind onto the other hub. Inverting the cartridge places additional sound tracks in playing position and permits the tape to rewind onto the first hub.

The two halves of the case have cored open-

IN RECORDING

Magnetic tape "magazine," molded of general-purpose polystyrene, may bring new boom to tape recorder industry

ings in which the hub, molded with a shoulder around the edge that serves as a bearing surface, are free to revolve. When the cartridge is placed on the machine, spindles pass through the center of the hubs and studs engage the other openings in the hubs to drive them.

Other openings in the case halves permit the wound tape to be seen, providing a visual index of remaining playing time. Along the front of the cartridge, finger-like projections provide a pathway for the tape and guide it through the heads and capstan. Designed with a butt joint, the case halves have undercuts along the back edge which interlock when assembled, necessitating only two self-tapping screws in the front edge to complete the assembly.

Low-friction surface

A flat recess molded into the inner surface of the lower case half accommodates the spring-loaded aluminum stamping whose serrated edges contact the reels and lock them when the cartridge is removed from the recorder. Die-cut sheets of 2-mil Mylar polyester film, used as inner liners next to each half of the case, provide a low-friction surface against which the tape can coil smoothly as the recorder operates. To some extent, these liners also help to seal out dust and dirt by covering the observation slots in the case. In the lower case half, the Mylar film acts as a separator between the coiled tape and the aluminum braking strip, which must be free to move without binding the tape.

On its outside surface, the plastic case is molded with a recessed area in the center to accommodate a paper label which is cemented in position. One side of the case is identified as *A* and the other as B with molded-in letters to expedite handling of the cartridge by the user.

American Molded Products produces parts for the tape cartridges on a 12-oz. injection machine, using Koppers Type 8 styrene material. Center gating is used on both case halves and on the reels, molded of the same type material, to obtain more uniform strength properties.—END

TAPE CARTRIDGE for magnetic recording slips easily into place on specially designed recorder-player. Manual threading is eliminated.

Specialized baths in

Outstanding use properties, as well as production economies unattainable with metal, are achieved in two unusual RP products

A compelling case for plastics—both cost-wise and performance-wise—is made by the Monobath and the Sit-a-Bath, two specialized "bathtubs" manufactured by De Lucien, Inc., South Bend, Ind.

Both items are produced of fibrous glass reinforced polyester by hand layup techniques, using reinforced plastics tools. Both would be extremely difficult and much more costly to fabricate of metal, according to Dale Cosper, president of De Lucien; and, even then, they would have so many undesirable features that it wouldn't be worth the effort.

Vapor bath has no counterpart

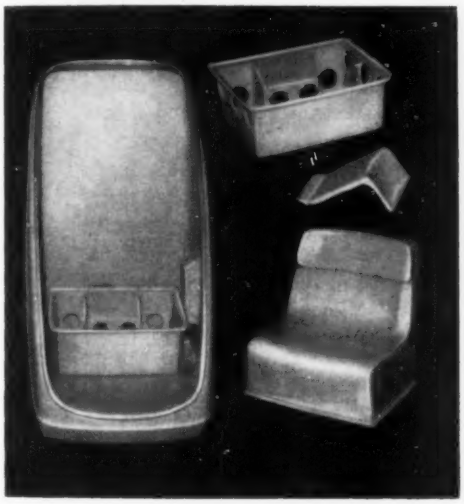
The Monobath is a de luxe-type vapor bath cabinet designed for beauty parlor and other professional use, as well as for installation in the home. Retailing at $495, it is a handsomely styled, high-quality unit having no counterpart on the market. Its sturdy outer cabinet, 44 in. long, 43 in. high and 27 in. long, is a one-piece, seamless reinforced plastics molding. Also of glass-reinforced polyester construction are the seat and seat base which fit inside the cabinet.

The Sit-a-Bath, a $195 product, is a two-piece unit specially designed to provide running water baths for aged persons or invalids. Mounted on a chrome-plated tubular steel stand equipped with casters, the Sit-a-Bath is wheeled into position over a water closet. Water used during the bath empties directly into the closet. Water collecting in the separately molded foot tub is drained by lifting it to a horizontal position. Like the Monobath, the Sit-a-Bath was styled by Wallace Sparks, Sparks Design Consultants, South Bend. It is expected to have a large market among the nation's 25,000 nursing homes, as well as in hospitals, doctors' offices, and private homes.

The Monobath is supplied in a choice of coral pink or desert tan, while the Sit-a-Bath is produced in a pleasing pastel green. In both instances, the resin is colored and no surface finishing operations are required. Glass cloth and mat used by De Lucien are supplied by Ferro Corp., Fiber Glass Div., Nashville, Tenn.;

PARTS of sitz bath include the main unit mounted on metal stand so that it can be positioned over water closet, and removable foot rest, which weighs only 10 pounds. Use of reinforced plastics construction gives product pleasant feel to the touch and eliminates rust and corrosion poblems. Water collected in the foot tub is easily drained into water closet after bath.

reinforced plastics



COMPONENTS OF MONOBATH include cabinet and seat base at extreme left, removable baffle, and seat. Parts are produced by hand layup technique. Thermal insulating properties of material retain heat in cabinet and forestall condensation. Parts have molded-in color, require no surface finishing. Complete unit is above. Occupant enters through zippered nylon front.

polyester resins by Interchemical Corp., Finishes Div., Newark, N. J.; and Mol-Rez Div., American Petrochemical Corp., Minneapolis, Minn.

Advantages over metal

The superiority of reinforced plastics over metal construction, from the user's standpoint, show up dramatically in both of these units. Integral color means that there will be no loss of original beauty, despite long service and repeated exposure to moisture and heat. Light weight, particularly with the Sit-a-Bath, which must be moved frequently in use, is a major advantage. The foot tub of the Sit-a-Bath, weighing only 10 lb., is easily lifted into position or raised for draining. The complete Monobath weighs only 73 pounds.

The thermal insulating properties of the reinforced plastics are also of great importance in both products. Unlike metal, they do not become unpleasantly hot to the touch while in use. With the Monobath, this also means that heat generated by the heater-blowers in the base does not escape by conduction through the outer shell, but is retained for increased efficiency and lower operating cost. The low thermal conductivity of the material also precludes annoying condensation on the inside of the cabinet.

The Monobath includes four basic parts. In addition to the cabinet, these. *(To page 176)*

Plastics score in archery

There are about 5 million archers in the U. S. today and they are increasingly turning to plastics bows and arrows. Why?

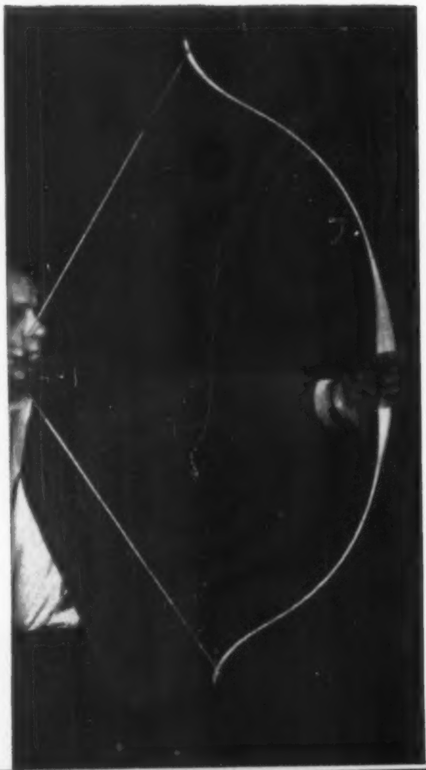
Unlike wooden varieties, plastics bows are not affected by humidity. They also stand up much better to the rough wear encountered in the field. As to arrows, the plastics types far outlast wood or aluminum types. The superiority of plastics bows and arrows has found recognition in two records they now hold. One is for range (651 yards, or one-third of a mile!); the other for accuracy.

Ways of making bows

Two basic methods for making plastics bows are being used. In one, the wooden bow is completely replaced by a solid molding or casting of reinforced plastics. In the other, plastic laminates are used to reinforce the wooden bow in the front and back.

Solid plastics bows, although originally made like plastics fishing rods (in some cases using identical mandrels and molds), actually require special processing techniques. A good bow, for instance, does not bend in the center near the handle. All of the "action" must be in the outer "limbs." Parallel Products Co., Waverly, Ohio, worked out a method of providing tension on the glass roving reinforcement during the 5 to 10 min. molding cycle. The company uses matched metal dies and simple deflashing is the only finishing required. In order not to disturb the glass reinforcement, a separately injection molded vinyl handle is assembled to the bow. Shaping of the bow handle into the molded bow would require cutting of glass fibers along critical front and back surfaces.

Other companies have developed special techniques for overcoming some of the other problems. One is weight (plastic bows are heavier than wooden or composite types); the other is that plastics bows may cause jarring on the arm upon release of the arrow. Ben Pearson, Pine Bluff, Ark., has reduced both these problems by introducing a bow with wooden inserts



SOLID reinforced plastics hunting bow, of short and high-stressed design, shows excellent form and "action" in all three conditions of being unstrung, strung, and at full draw.

Reinforced polyester and epoxy challenge supremacy of wood. Special production techniques overcome critical problems

buried in the plastic during the molding cycle. These inserts lighten the bow and at the same time absorb some of the release shock. Another Pearson innovation is a bow molded in two sections, held together at the handle by a steel sleeve encased in a phenolic molding. The bow can be disassembled for carrying; assembled, the two halves are held tightly in place by tension of the string.

Other major producers of solid plastics bows are Paul Bunyan Archery Co., Minneapolis, Minn.; Orchard Industries, Inc., Hastings, Mich.; and The United Archery Div. of Stream-EZE. All of the companies mentioned mold their bows principally out of polyester resins in matched metal molds, using glass roving as reinforcement.

Plastics composite bows consist of wooden "cores," to the front and back of which have been bonded reinforcing laminates. The ideal reinforcement has been found to be epoxy-glass laminates. Today a number of these laminates are on the market, differing primarily in the amount of pressure applied during cure and the technique used for providing a rough gluing surface.

Gordon Plastics, San Diego, Calif., winds roving on a 6 ft. by 12 in. "reel," with the strands running the length of the frame. The blanket of roving is then laid flat on a sheet of cellophane, saturated with epoxy resins, overlaid with a layer of glass cloth, and cured under moderate pressure. To prepare the laminate for gluing, the layer of partially saturated cloth is simply stripped off or "delaminated" from the roving-resin layer. The exposed surface, carrying the cloth pattern, is ideal for bonding; the cellophane on the opposite surface protects the laminate through the bow-making operations.

Rexco, Inc., Costa Mesa, Calif., makes a similar laminate, using mono-directional woven roving. Sheets of the cloth-like reinforcement are soaked in epoxy resin and hung in racks until the plastic has cured to the B-stage. Two sheets are laid face to face between heated stainless steel pressure plates coated with a release agent. After full cure, the two sheets are stripped from each other, providing a rough gluing surface.

Bow-making laminates are available in a wide range of colors, and in thicknesses from 0.030 to 0.080 inch.

As bow-makers have added plastics reinforcement, front and back, the wood portion of the composite bow has shrunk until it now consists of just a thick section in the center, where the hand-grip is carved, and narrow slivers of birch or maple veneer running from the handle out to the tips.

Veneers, handle block, and laminates are coated with adhesive and assembled in a pres-

Photos, Parallel Products Co.

FIBROUS GLASS roving under preparation for impregnation with resin and subsequent matched-metal molding under tension into solid reinforced plastics bows.

sure form that bends them into the desired shape during the ½- to 2-hr. cure cycle. Ovens, heated molds, and high frequency waves are all used to set the adhesive. The rough blanks are then band-sawed to shape and the handles sanded to pistol-grip contours. Finally, each bow is individually balanced and trued, wood and laminate being carefully sanded off until the limbs are able to "work" together in perfect harmony.

One company, Gelco, Inc., of San Diego, Calif. (recently purchased by Narmco Plastics), has improved on the basic composite bow design by replacing the hand grip with a solid casting of polyester and glass-fiber staple. The castings, measuring 15 in. by 1½ to 2¼ in., are made by a method that not only bypasses the problem of exotherm but results in uniform parts that are completely free of voids or bubbles.

Arrows pose a problem

Plastics arrows are generally made in a manner similar to that used in the manufacture of fishing rods. Glass cloth, saturated with polyester or epoxy resin, is wrapped around a mandrel and cured, either in a mold or in a cellophane wrap.

A major problem has been to achieve both strength and uniformity with reinforced plastics. Arrows require an extremely strong, uniform shaft material since the full force of the bow string is impressed on an arrow shaft at the moment of release. Uniformity from arrow to arrow is also an absolute requirement; archers correct for windage and drift by watching the path of previous arrows so each arrow must be exactly like all others in the quiver.

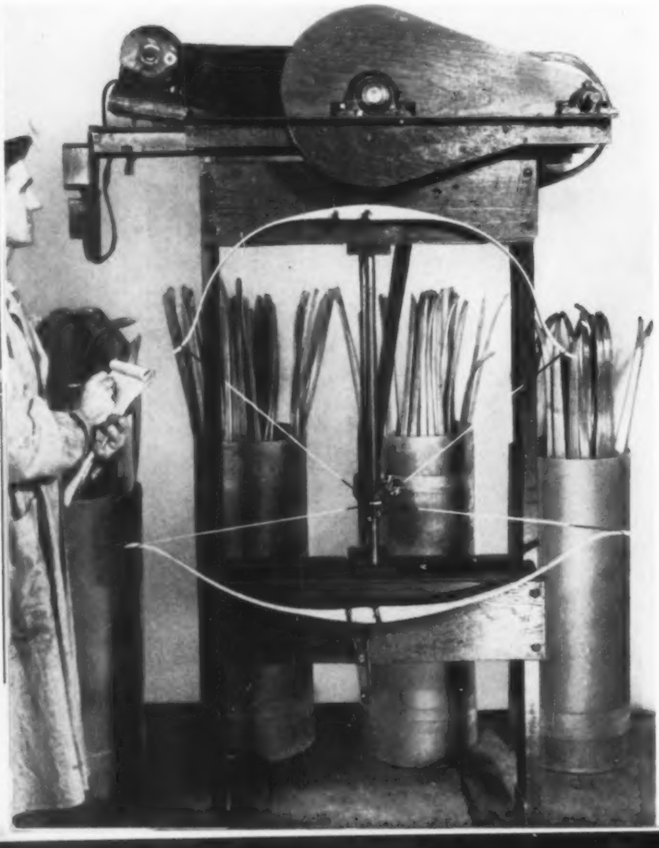
Paul Bunyan Archery has made a move toward perfecting balance and uniformity by using only parallel lines of roving along the arrow shaft, eliminating the edge that occurs even with mono-directional woven roving.

Rexco, on the other hand, depends on high pressure to achieve uniformity. B-stage laminate, similar to that used in the bow-laminate, is wrapped around a tapered mandrel. The outside is soaked in a special thermosetting resin formulation that acts as a lubricant during the initial forming of the arrow shaft, and as a release agent after it is cured. The wrapped mandrel is then forced, under pressure, into a tapered cylinder (both mandrel and cylinder have a taper of approximately one part in a thousand). The high pressures involved result in a dense, highly reproducible laminate. A molded epoxy insert is bonded into place at the arrowhead end, and the shaft is ready to ship.

The complete arrow consists of shaft, arrowhead (usually of brass or steel), feathers, and, finally, the nock for fitting the arrow to the bowstring. The nock transmits the force of the bow to the arrow; it is also part of the arrow gripped by the fingers at the critical moment of release. Injection molded plastics nocks provide a uniformity and smooth surface that cannot be matched by any other material. Most arrows today are fitted with nocks molded of acetate or styrene. A new nylon nock has recently been introduced by Gries Reproducer Corp., New Rochelle, N. Y. Claims for the nylon unit include higher strength, less danger of splitting, and more comfortable grip.

The price range for plastics bows and arrows is, at this time, slightly higher than for their wooden equivalents. This, however, is of minor importance to the sportsman who is accustomed to paying higher prices in related equipment and is interested primarily in strength and performance. Here is a prime example of plastics filling a need, not as a cheap substitute, but as a superior product.—END

TESTING of reinforced plastics bows is carried out to check strength and elasticity over wide temperature ranges and to determine degree of jar upon release of the drawn string.



CONVENTIONAL LAP JOINT is used to connect section of A-C high-density polyethylene pipe of 8-in. diameter. Other methods have also been developed to join this pipe, which has been experimentally made up to 20 inches.

When you want polyethylene, know what you want–Part 3

The great variety of polyethylene resins available today makes it possible to select materials effectively tailor-made to fit the need of process or application. The three most important factors in such selection are melt index (MI), density, and molecular weight (m.w.) distribution. The first two articles in this series dealt, respectively, with molding materials and bottles (MPL, Oct. 1958, p. 83) and films and coatings (MPL, Dec. 1958, p. 98). This concluding article covers pipe and wire coating.

RESINS FOR PIPE

Resin consumption for this application is currently running at over 50 million lb. a year, with a 100 million-lb.-a-year rate expected soon; but there is no agreement on how much of this material is off-grade or reprocessed. All producers sell a first-grade compound from which the better types of PE pipe are produced, but pipe producers have developed an enormous market for pipe made from off-grade material. Competition being what it is and with profit margins low it is likely that this condition will continue indefinitely.

A great portion of off-grade material is upgraded by compounding with carbon black and a small portion of first-grade material. Most pipe producers, in fact, sell two grades to meet different requirements.

Resin producers, taking cognizance of the chaos in the pipe industry, began several years ago to introduce specially compounded pipe-grade resins—that now sell at premium prices. This development has made it possible to obtain a tailored resin and a finished product that wouldn't fail under ordinary service conditions.

Overcoming difficulties

Perhaps the foremost task for polyethylene pipe makers is to manufacture a product that will successfully cope with problems of weathering, stress cracking, creep or distortion, and bursting.

Weathering: It is well known that polyethylene deteriorates in sunlight; but the addition of

FLANGED SECTIONS of straight pipe and elbows, made from USI polyethylene, are stockpiled on an installation site prior to assembly. Elbows were fabricated by hot-gas welding, using filled rods of extruded polyethylene.

carbon black will overcome that problem. Consequently, resin producers now generally add about 2½% carbon black to their compound and charge 2¢ or 3¢ a pound more than the 35¢ charged for uncompounded PE. Sometimes a masterbatch which contains 25% or more carbon black is sold to the extruder at around 50¢/lb. and he in turn compounds that with natural PE.

An interesting experiment is now going on by which a 50-50 combination of carbon black and PE are cross-linked to form a thermosetting compound and produce a material which is said to be 50% stronger than conventional polyethylene pipe. The result is similar to that which is obtained when rubber is cross-linked with carbon black for making automobile tires.

Stress cracking, burst strength, creep: These problems are generally overcome by the proper choice of density and melt index, as well as by proper manipulation of the extrusion process itself. In conventional PE pipe stress cracking and creep are likely to increase as density and MI go up. But if the density is too low the pipe will be soft, and as MI goes down speed of extrusion is impaired. Conventional pipe grades now vary from 0.917 to 0.926, and the MI is generally around 2. Each producer claims superior burst strength, improved creep resistance, and excellent stress crack resistance at the higher densities. One producer lists only one pipe grade at 0.926 density, collects ½¢/lb. more than the others, and apparently believes that an extruder should not fool around with various densities and MI's but concentrate on one particular grade tailored especially for pipe.

Medium density PE is seldom used for pipe, probably because of cost, but one producer offers a 0.935 density material with an MI of 1 which assertedly has properties superior to the lower-density materials, with the additional property of better surface finish. It sells for 42¢/lb.

High-density resins

High-density, linear polyethylene producers had a slow start in pipe because of stress-cracking problems. Ziegler PE producers assert that their material has a somewhat higher m.w. than Phillips' original PE and that it has less of a tendency toward stress cracking; but Phillips and its licensees have just come out with a new series of 0.950 density resins which is claimed to help solve the problem.

High-density PE producers assert that wall thickness can be considerably reduced—within the limits of established codes—by using their material. It is customary for pipe users to buy according to a wall thickness that will withstand a desired pressure. Some pipe extruders now blend high-density and conventional PE compounds to obtain the requisite wall thickness.

All linear producers are confident that they will one day have a big market in rigid and flexible high-density pipes; but they admit that maintaining both high-density and high molecular weight may raise the melting point and make extrusion more difficult. Hercules (Ziegler type) has a 1700 series for pipe that doesn't even register a realistic MI. Its m.w. is so high that not enough is extruded to apply standard measuring techniques. Koppers (Ziegler) 6002 type for pipe has a melt index of 0.2, which is mighty low. (A melt index of 2 in conventional PE corresponds roughly to 0.9 in high-density material.) However, Phillips asserts that the material in the 0.950 density range mentioned above, which has an MI of 0.3, shows good results for long term stress crack resistance and that its original material in the 0.960 density class has been used successfully in water mains that withstand from 100 to 150 lb. working pressure. Thousands of feet have been used for frames to hold roadside signs, and the Phillips polyethylene plant located near Houston, Texas, employs many hundreds of feet of linear polyethylene pipe as well as belting in its operations.

Another development in high-density pipe is Allied's A-C Polyethylene pipe compound which, company technicians assert, is quite different from the material of any other firm. The

resin was introduced in commercial quantities in April, 1957. It is stated to have a molecular weight of 750,000 and for that reason to have several outstanding properties. These, according to Allied spokesmen, include good long term properties (established by extrapolation techniques), high strength, complete absence of stress cracking, resistance to cycling pressure loading as in water hammer, good chemical and solvent resistance, adequate coilability, good abrasion resistance, no notch sensitivity, excellent weatherability, working temperatures up to 150° F. under pressure and up to 212° F. under atmospheric pressure.

But the material has an unusually high melt viscosity, or very low melt index, and consequently a special extrusion technique had to be worked out. According to Allied, high productivity rates have been obtained with that technique, therefore, it is no longer considered a handicap.

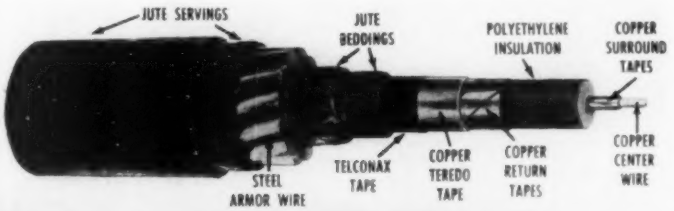
The Allied Chemical material is being used today in jet wells, water tie-in lines to new houses, gas lines, chemical process plants, radiant heating, rural waterlines of all kinds, mine waste water disposal lines, and many other similar applications. In addition to standard ½- to 2-in. pipe, the material has been used successfully in making commercial pipe of up to 8-in. in diameter (see photo, p. 103).

WIRE COATING

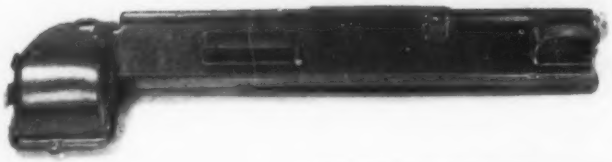
The picture for wire coating resins is not as complex as that for pipe. For conventional PE, densities range from 0.914 to 0.930 and melt indices from 0.3 to 3.4. Molecular weight is of prime importance because of its influence on processing and stress cracking. The higher the weight the better the resistance to stress cracking, but as m.w. goes up extrusion becomes more difficult.

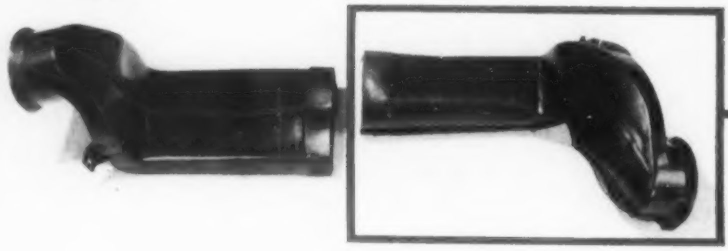
Processability is a key factor. Toughness and ability to withstand environmental cracking are also necessities. Good weathering properties are incorporated in the material by addition of 2½ to 3% carbon black. Electrical grade resins in low-density PE sell in a range from 37 to 48¢, the latter of which is flame retardant and thought to be a clorinated material.

Polyethylene was first used for wire insulation by the British in radar equipment during World War II. It was used again and in great quantities, for infantry assault wire during the Korean campaign. In those days *(To page 178)*



SUBMARINE telephone cable, incorporating wire coating based on Bakelite polyethylene resin is coiled in tank aboard ship. Each tank holds 400 miles of cable. Inset at right shows the construction details of the cable.





POLYETHYLENE DUCTS fabricated of molded halves (see close-up of one of the units at right) are securely attached to the reinforced plastics manifold by simple snap-fit.

2 revolutionary car parts

Molded high-density polyethylene and reinforced phenolic in two automotive applications improve product and performance at savings in cost

The automotive industry has long been of particular significance to plastics. For one thing, it represents a large market; a successful automotive application for any material means volume sales. For another, its use of plastics implies in every case a *proven* application. Because of the nature of the product, car makers' requirements are stringent. The choice of a plastic material for any car part is prima-facie evidence of its superiority, in terms of properties, economics, or both.

The two applications described below are cases in point. They are not in the glamour category; and few car owners will ever encounter them during the life of their vehicles. But in each instance they contribute to improved operation of the car—at a saving in cost.

The first application is a molded high-density polyethylene defroster duct introduced in the 1958 Chrysler.

Two ducts are required per car. Earlier materials used were an elastomeric composition which involved a cost of $1 per duct, and a compression molded polyester premix at 53¢ per unit. The polyethylene ducts run about 40¢ each. Beside the price advantage, the polyethylene parts also overcame problems of brittleness, harmonic resonance, and air leakage associated with the earlier constructions. Tooling costs were reduced, too, because the new ducts could be molded three times as fast as the older units, making fewer molds necessary. There was also a weight saving: the polyethylene ducts weighed only 0.8 lb., 1.4 lb. less than the polyester versions. Finally, the thinner walls of the new ducts made it easier to fit in all the other equipment that must be crammed under the dashboard.

Strength requirements were not the deciding factor in this application: 1) air pressure differential is very low; 2) the ducts do not serve as structural members; they are in fact supported at both ends by the reinforced polyester hot-air manifold and the defroster outlets.

Relatively thin wall sections were therefore adequate.

Temperature requirements, on the other hand were fairly stiff. The ducts had to be dimensionally stable for long periods of use at 160° F. Worse yet, with cars occasionally left standing in paint-drying ovens during lunch hours, ducts were exposed up to 220° F.

The ducts are injection molded in two parts by Perry Plastics, Inc., Erie, Pa. The two parts are later stapled and welded together. Wall thickness is 35 mils—the polyester duct walls were 100 mils thick. The material used is Koppers black high-density polyethylene.

Installation is easy—the new ducts are simply snapped into place over the manifold and defroster fittings without need to anchor them to the firewall; the earlier units required special metal lugs for screw attachment.

Transmission part

The second application is a clutch cone molded of glass-reinforced phenolic. It represents the first entry of plastics into the field of automatic car transmissions. Three leading 1959 automobiles are using it.

Technically, the part is a reverse clutch stationary cone. It serves as a brake against which the steel ring gear of a planetary train is stopped while the automatic transmission is under power. The part is subjected to severe static and dynamic friction, developed heat, a 5000-lb. force of the actuating piston, and the chemical effects of transmission oil.

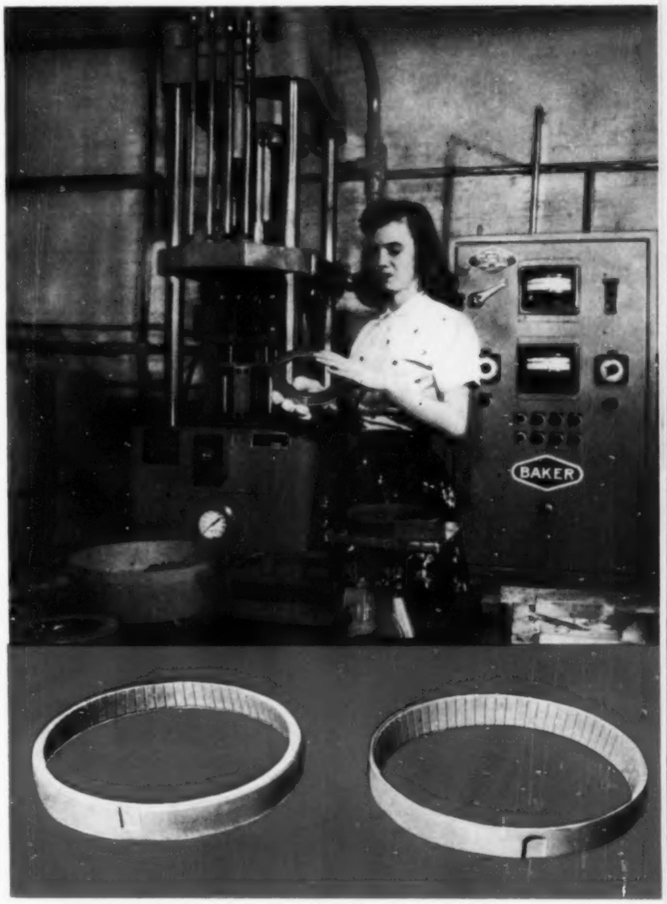
The idea of using plastics arose when it became evident that because of the increasing torque of modern car engines, the holding power of the various clutches had to be increased. This could be accomplished theoretically by making them larger or by making the applied pressure greater. Since present car design made either alternative unfeasible, engineers looked for a new material.

The material they selected was Durez 16771, a phenolic-impregnated fibrous-glass-roving molding compound. It combined three essential properties: high hoop (tensile) strength, resistance to transmission oil, and resistance to transmission temperatures. In tests for holding power, conducted by automotive engineers, the phenolic cones decisively outperformed conventional metal counterparts. In addition—although no precise figures are available for publication—use of the phenolic cone results in lower production costs (because of fewer machining operations) and reduced weight.

The phenolic clutch cones are produced by Smith-Way Plastics Co., New Hudson, Mich., on three automatic presses manufactured by Baker Brothers, Inc., Toledo, Ohio. The parts measure $6\frac{1}{2}$ in. O. D., and can be produced in larger sizes to meet the requirements of higher torque engines. Cone angle tolerances are held within ± 11 minutes.

In manufacturing the cones, Smith-Way first makes preforms of the material. The preforms are then mounted in a custom-built steam cabinet to be moisturized, and finally conditioned in a humidity and temperature control room. Molding takes place at temperatures over 300° F. A grinding operation removes all the inside diameter excess, after which each of the parts is rough-brushed by machine and the slots cleaned manually.—END

OPERATOR REMOVES molded clutch cone from automatic press. Preform can be seen on scale in front of operator. Inset at bottom shows two finished cones, with excess I. D. removed.



1 Molded entirely of acrylic, a new radial type level has one-material construction that eliminates fluid loss and errors through differential expansion with changes in temperature. The level is small enough ($1\frac{5}{8}$-in. diameter) to fit easily into a pocket. Accuracy is within 60 ft. of arc. The top and mounting flange of the level are of clear acrylic for full visibility of the bubble, while the bottom is white to provide a clear background for readings. Manufactured by the Johnson Products Co., Milwaukee, Wis., of Rohm & Haas' Plexiglas.

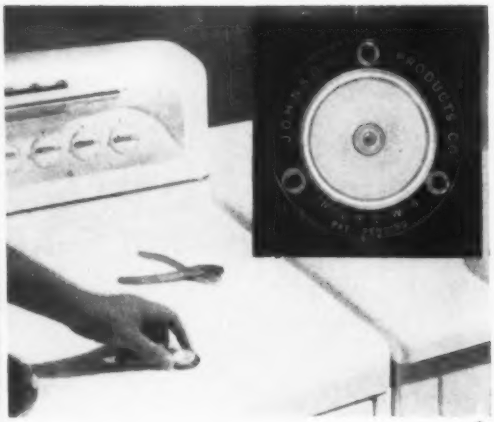
2 Unique polyethylene squeeze-bottle closure of two-piece construction permits contents to be ejected from the container when the cap is pulled up, and seals it when the cap is pushed in. The closure cap may be of one color and the base another, to act as an effective open-and-closed indicator. Product of U. S. Cap & Closure Co., Chicago, Ill., using Bakelite polyethylene.

3 Latest in disposable drinking cups is a 9-oz. container injection molded of polypropylene. Because these cups can be sterilized and are almost indestructible, they are being used in hospitals at a great cost saving over glass tumblers that are generally used. The polypropylene cups are produced by Crown Machine & Tool Co., Ft. Worth, Texas, using material supplied by Koppers.

4 Polyurethane foam with self adhesive backing, besides being effective weather stripping, has many other uses. The self-adhering tape can be used around the bases of electrical appliances to reduce vibration, for refrigerator and freezer doors, for taping tools and garden implements to prevent hand blisters, and around car doors to minimize rattles. The tape comes in lengths of 162 in. and width of $\frac{3}{8}$ in., and in two depths —$\frac{1}{4}$ and $\frac{1}{8}$ inch. Manufactured by Little Falls Import Co., Little Falls, N. J.

5 Here's a way out for pets that always seem to be on the wrong side of the door—the FlexPort, a two-way closed porthole for animals. Eight triangular polyethylene film vanes are arranged in a photographic shutter-like pattern and are held in place by an aluminum frame and ring.

PLASTICS



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To enter the FlexPort from either direction, a pet pushes through the soft center of the iris, which offers little resistance to nose and head. Then, as the pet pushes through the opening, the triangles close down evenly over the contours of its body. Produced by Turen, Inc., Danvers, Mass.

6 Molded vinyl sirup-dispensing pump puts the sirup just where it's wanted. It eliminates dripping and is fun for children. The pump has long life, will not clog, and can be washed clean with soap and water. The pump is offered as a premium for 25¢ with Cocoa Marsh. Manufactured by the Calmar Co., Los Angeles, Calif.

7 Trash unit to facilitate daily clean-up in commercial, institutional, or industrial establishments can be used for any wet or dry collection chore. It consists of a large, 10-gage heat-sealed vinyl bag suspended from a lightweight steel tube frame on casters. It folds for storage, and is pushed with little effort. Both 4- and 6-bu. vinyl bags are available. Product of Walton-March, Highland Park, Ill.

8 Half-gallon household container saves space in the refrigerator, is easy to use, and has graduation markings in pints and quarts. Molded of high-density polyethylene, it can be sterilized by boiling. Closure is attached by molded-in tape; recessed grip makes for convenient handling. Molded by Plastic Metal Mfg. Co., Chicago, Ill., of Grex from W. R. Grace & Co.

9 Thirty-three injection-molded styrene parts go into a realistic model kit of the American Bald Eagle. When assembled, the eagle has a 21½ in. wingspread. Kit retails for $1.80. It is a product of Precision Plastics Co., Philadelphia, Pa.

10 A household tool kit designed specifically for women features reinforced plastics and metal-flecked acrylic handles. The tools are relatively small, lighter than men's tools, and styled for the feminine trade. The kits are available in assortments of six, seven, and 10 tools. Manufactured by Consolidated Tool Co., Los Angeles, Calif., shafts of Owens-Corning Fiberglas by New Plastic Corp., Hollywood, Calif. Acrylic supplied by Du Pont.

PRODUCTS

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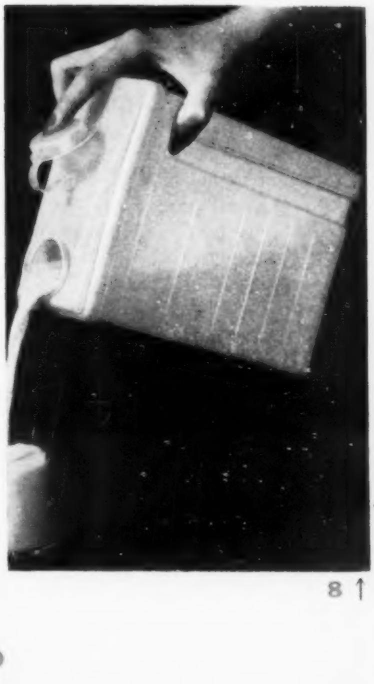

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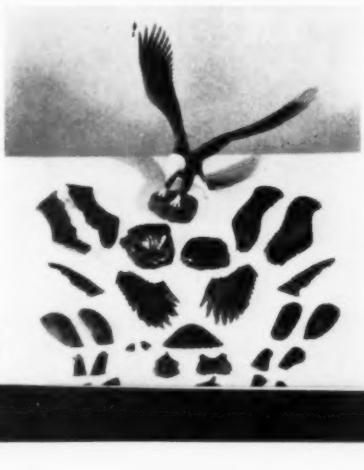

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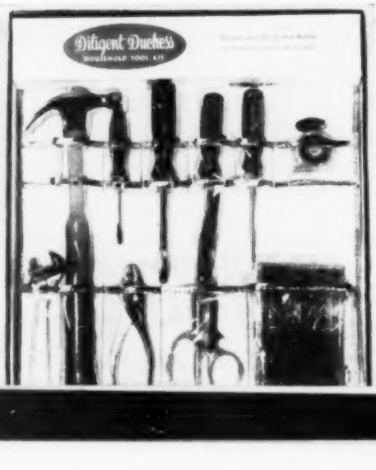
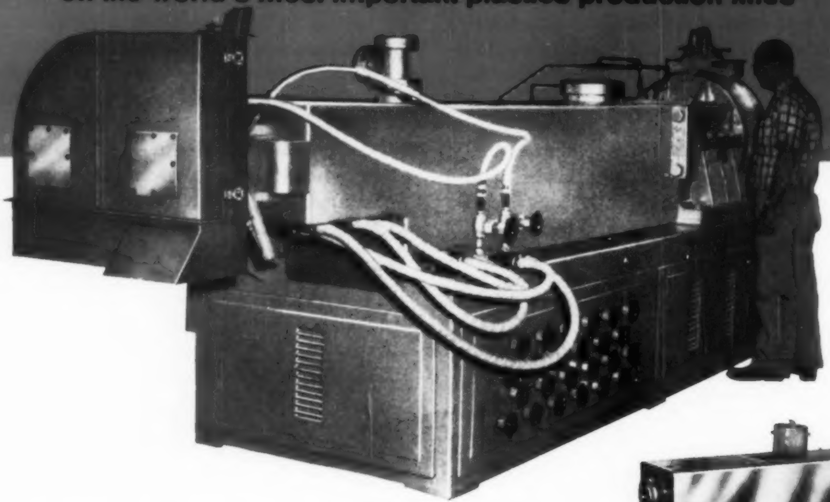


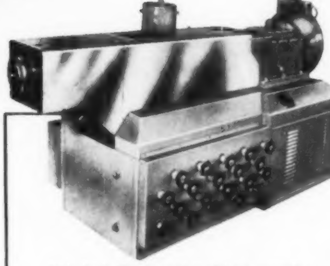
10 ←

WEI Dual Worm Equipment Has Pre-Proven Ability to Master the Toughest Processing Jobs

It is a habit with Welding Engineers Compounder-Devolatilizer-Extruders "To Start Where Others Must Stop"... to be the key equipment on the world's most important plastics production lines



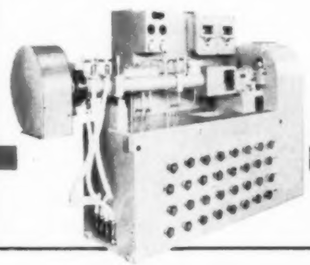
Typical 4½-inch polystyrene or high density polyethylene processing machine.



3½-inch thermoset molding powder manufacturing machine.

•

2-inch F, V2, S laboratory experimental machine.



When you invest in WEI dual worm equipment you *know in advance* exactly what production advantages you can count on: output and quality is pre-proven in our own research-engineering development and testing laboratories under conditions which coincide precisely with the dictates of your own manufacturing methods and with your own materials. This, indeed, is the kind of laboratory promises and experience data that makes sense to Boards of Directors as forceably as it does to technical and operating people. With dual worms the arrangements and variations in the flight characteristics permit the optimum in efficiency and ability in custom-fitted equipment that enjoys a worldwide reputation for reliable, economical, trouble-free service.

WEI

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NORRISTOWN, PENNSYLVANIA

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Molding and forming the new polyolefins

By Russell D. Hanna† and John Y. Lomax†

This article summarizes experience to date with the molding and forming of polypropylene and compares it with high-density polyethylene. Enthalpies, specific volumes, and shear-rate/shear-stress data are presented for most of the processing temperature range; their relationship to processing is discussed. Graphs of required heating time for sheets vs. heater temperature and sheet thickness show that fast heating is safely achieved by radiation with high-watt-density heaters. Suggestions are made for sound mold design and for minimizing warping and shrinkage of molded and formed pieces.

In many ways polypropylene resembles other thermoplastics, in other ways it is unique. In processing this new plastic, there are no "absolutes" which, if followed, guarantee success or, if disregarded, can bring only failure.

The approach here will be to rely on principles, which are the same for polypropylene as for thermoplastics in general, and to 1) consider how the properties of this resin may affect mold design and 2) indicate how optimum molding conditions may be established for a particular application.

The design requirements of any article fall into three main classes: performance, esthetics, and processing. Some of the engineering properties of primary interest in part design are listed in Table I, below. In general, the material is similar to high-density polyethylene; it is somewhat stiffer and harder, has considerably better heat resistance, but has a higher brittleness temperature.

Table I: Typical properties of injection molded polypropylene

Property	*ASTM test designation*	*Value*
Specific gravity	D 792-50	0.901
Tensile strength, p.s.i.	D 638-56T	5000
Elongation at yield, %	D 638-56T	11 to 15
Flexural strength, p.s.i.	D 790-58T	8000
Stiffness in flexure, p.s.i.	D 747-50	175,000
Izod impact, unnotched, ft./lb.	D 256-56	33
Surface hardness, Rockwell R	D 785-51	95
66-p.s.i. heat distortion temperature, °F.	D 648-56	221
264-p.s.i. heat distortion temperature, °F.	D 648-56	140
Tensile strength at 212° F., p.s.i.	D 638-56T	1720
Coefficient of linear thermal expansion in./in., °F.	D 696-44	4.7×10^{-5}
Brittleness temperature, °F		*ca.* +15

INJECTION MOLDING

The design of polypropylene products should minimize weld lines, sinks, and air traps. Radii should be generous. Uniform wall sections are best, and changes in thickness should occur as gradually as possible. Because of its high mold shrinkage—typical of polyolefins—and the differential shrinkage among sections of different thickness, heavy ribs, bosses, and fillets should be avoided or minimized by rounding into the walls and increasing the wall thickness slightly in those areas. Typical observed shrinkages, depending on conditions and part design, have been: 10 to 17 mils/in. in sections 62 mils thick, up to 21 mils/in. for quarter-inch sections. Once on cycle with a given molding, the piece-to-piece variations in shrinkages are negligible.

Where greater rigidity is needed, channels and curved walls are preferable to ribs. Curved lines often improve the product's appearance, too.

Mold construction

The principles of mold design valid for most thermoplastics are just as important to the success-

*Reg. U. S. Pat. Off.
†Hercules Powder Co., Parlin, N. J.

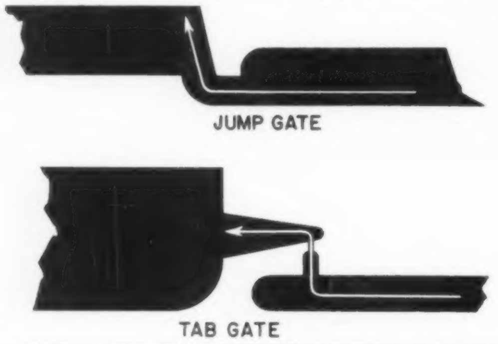


FIG. 1A: Jump gating (above) and tab gating are frequently helpful in achieving good flow into mold when simple gate can't be located to cause early impingement of melt on the cavity wall.

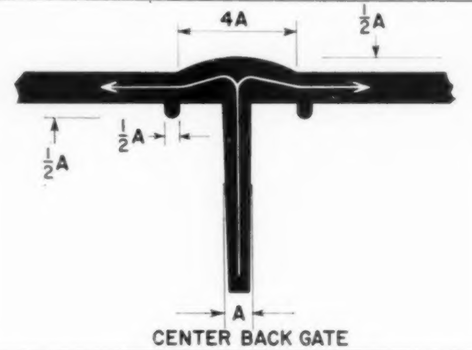


FIG. 1B: Sketch of center-back gating, a method particularly useful for large moldings where it provides uniform and symmetrical fill.

ful molding of polypropylene. It has been molded in two- and three-plate molds, molds with hot runners, no runners, and valve gates—any basic mold construction can be used.

Full-round runners are best, trapezoidal runners being the best substitute when the entire runner section must be in one plate because of cam or slide actions. Runner surfaces should be left unpolished after fine machining: a somewhat rough surface keeps the cooled skin from sloughing into the cavity and marring the surface finish of the piece. Oversize runners—$\frac{1}{4}$ to $\frac{3}{8}$ in. in diameter—stepped down $\frac{1}{16}$ in. at each branch, along with substantial over-runs at each turn to serve as cold-slug wells, will help prevent problems in filling most molds.

Gating

Gate size should be the minimum needed to permit filling; for most small, multi-cavity work this will be 30 to 60 mils. Round gates are recommended wherever applicable, and they should be so located that the melt impinges against a mold surface to build up a smooth flow of melt into the cavity, preventing jetting and "worming." Gate lands should be no more than 40 mils long. In filling heavy sections and pieces requiring long flow, gates may have to be 90 mils and larger in diameter to prevent sinks and voids. Jump and tab gates, which are sketched in Fig. 1A, above, are frequently helpful where the piece design would not provide impingement with the simple gates.

Many articles, particularly large moldings, are best gated perpendicularly into one of the large areas (back gating). This gives uniform and symmetrical fill and minimizes flow distance. Satisfactory dimensional ratios are shown in Fig. 1B, a sketch of the gate area of a back-gated part. The dimple helps prevent sinking and voids by keeping the gate area fluid till the other areas have set up. The ring around the sprue serves the same function and is also recommended where permissible.

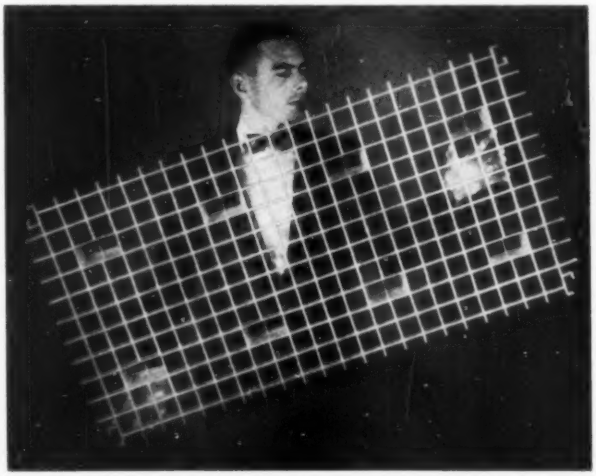
Location of the gate is an individual problem with every part. The best procedure is to visualize the flow from various locations, then choose the one that will minimize jetting, sink marks, weld lines and air traps, based on past experience with such faults. If possible, weld lines—often weak—should form along lines that will be lightly stressed in service.

Multiple gating may be necessary to reduce flow distances, improve flow patterns, and locate welds along lines of low stress. The cooling tower grid of Fig. 2, below, made by Fluor Products Co., Whittier, Calif., is an example of what is possible with multi-gating of polypropylene molds. It was molded in a three-plate mold with 10 gates.

Warping

Almost everyone who has molded polyolefins has faced the problem of a center-back-gated tray, box, or plate distorting unsymmetrically over the flat sur-

FIG. 2. 52-oz. lighting grid, measuring 23 by 47 by 2.6 in., was molded from polypropylene in a 10-gate mold.



face into a shape known as a "figure 8" or "saddle warp." This is a result of the radial shrinkage being greater than the circumferential shrinkage, which is a consequence of the flow pattern during filling.

These shrinkages can be equalized, at least in part, if the thickness of the flat section is increased slightly with increasing distance from the gate, making the section heaviest at the remotest points. The heavier sections will tend to shrink more and in a circumferential direction, counteracting the reverse effect of the flow pattern. A particularly difficult warping problem of this type was overcome in a center-gated, 10-in. dinner plate by tapering the bottom section from 82 mils thick at the gate to 92 mils at the edge. At the same time, the gate was enlarged from 45 to 65 mils, permitting faster filling and reducing the flow orientation responsible for the differential shrinkage.

Stripper plate ejection is preferable to ejector pins, since in the former the pressure is applied in a more uniform matter and is less likely to cause distortion. Ejector pins, if used, should be as big as possible and should work against those sections of the molding that provide greatest stiffness and strength. Deep-draw parts are often ejected with compressed air; however, if they must be ejected mechanically, a vacuum-breaker valve should be used to prevent distortion. Long cores should be tapered about 1 degree.

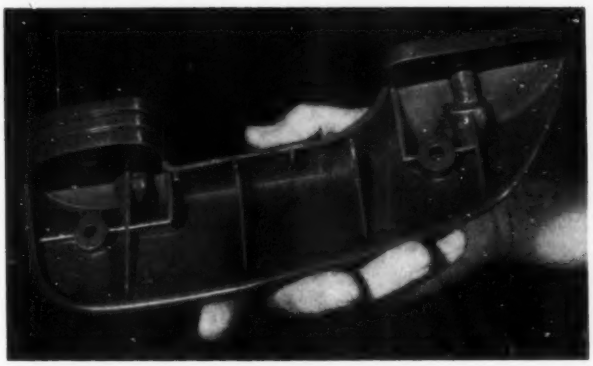


FIG. 3: Through close control of mold temperature, polypropylene arm rest was molded in an unaltered butyrate mold.

Mold temperature

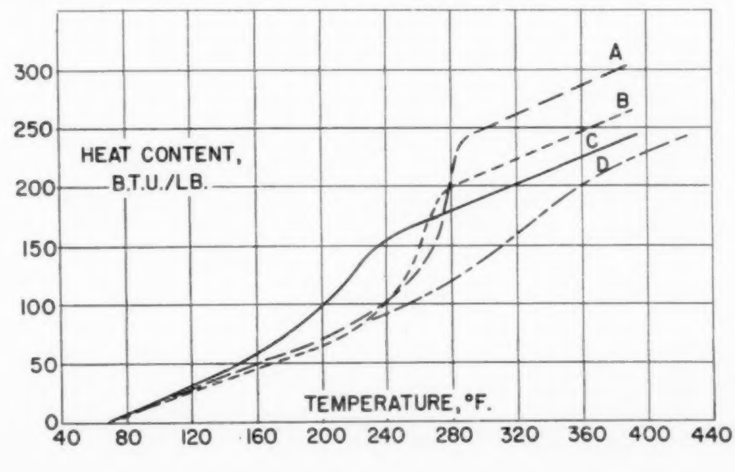
An important requirement for successful polyolefin molding, repeatedly discussed in recent articles and papers but still not widely appreciated, is closely controlled, graduated mold cooling. This requires plenty of cooling channels, located in such a way as to concentrate the cooling in the gate area and thin it out at the extremities. Graded cooling helps offset the differences in temperature and set-up time between the material that first enters the mold and that which enters last. Good mold temperature control has made it possible to mold acceptable polypropylene parts in molds designed for the shrinkages of other plastics. The automobile armrest shown in Fig. 3, above, is a case in point. By carefully controlling mold temperature, this piece was molded within tolerances in a mold designed for butyrate.

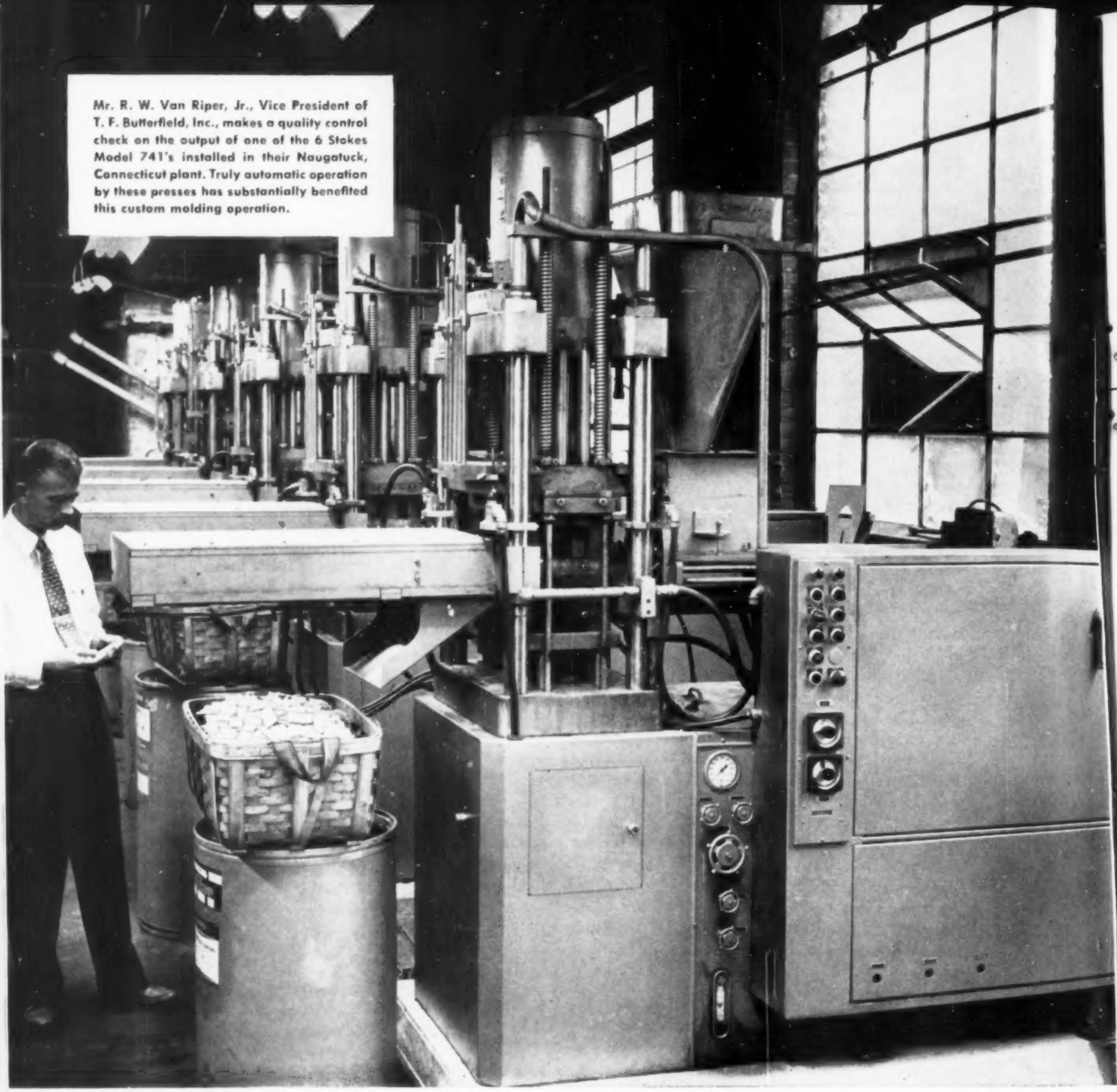
With thicker sections, higher mold temperatures are advisable to prevent formation of shrinkage voids in the finished piece.

Opening the gate to permit packing during cooling also helps prevent voids. A word of caution in this connection: before lengthening the cooling time to prevent voids, one should examine carefully the need to prevent the voids. These usually occur in the soft centers of thick sections and consistently in the same vicinity inside the piece. Where the principal loads on the piece are tensile, the load-bearing capacity will be reduced in proportion to the reduction of cross-section. On the other hand, if the piece is to be subjected to bending and/or twisting loads, surprisingly large centrally-located voids will never be noticed, strengthwise. Since thick polypropylene sections are opaque, the voids cannot be seen. Too often much effort is spent and much cycle time lost eliminating voids whose only harm is a funny feeling they cause in the pit of the molder's or the buyer's stomach. Of course, voids may lead to unsightly sinks that must be eliminated.

In sections under about 60 mils, the transparency of polypropylene (in percentage of light passed per mil of thickness) increases with the rapidity of cooling, and shock cooling may be warranted in some applications. (*To page 116*)

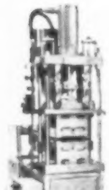
FIG. 4: Heat content (above 68° F.) for four polyolefins. Curve A: polyethylene of 0.96 density; curve B: polyethylene of 0.945 density (Hifax); curve C: low-density polyethylene; curve D: polypropylene.



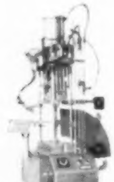


Mr. R. W. Van Riper, Jr., Vice President of T. F. Butterfield, Inc., makes a quality control check on the output of one of the 6 Stokes Model 741's installed in their Naugatuck, Connecticut plant. Truly automatic operation by these presses has substantially benefited this custom molding operation.

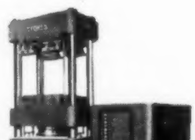
OTHER STOKES PRESSES FOR THERMOSET MOLDING



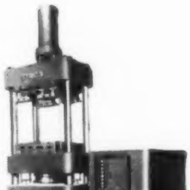
The Stokes Model 800 automatic . . . 15 and 25 ton models. Has all the advanced features of the larger Model 741's.



The Stokes Model 725 automatic . . . 25-ton capacity. A simple low cost machine for varying production runs.



The Stokes Model 726 semi-automatic compression molding press. 50, 100, 200 and 300 ton models.



The Stokes Model 727 semi-automatic transfer molding press. 50, 100, 200 and 300 ton models.

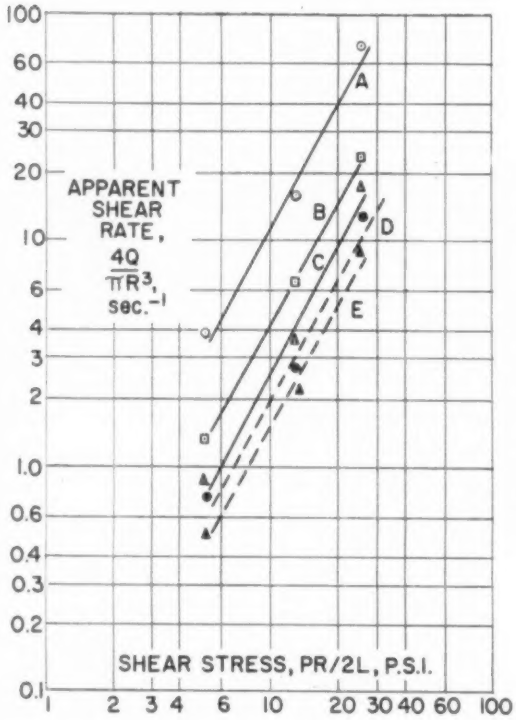


FIG. 5: Shear rate vs. shear stress for polypropylene and high-density polyethylene (Hi-fax). Lines A, B, and C are for polypropylene at 482, 410 and 374° F. respectively; lines D and E are for polyethylene at 410 and 374° F. (Values calculated from measurements made in melt indexer with weights up to 22 pounds.)

To design the cooling system properly, one must know how much heat is to be removed. This can be calculated from the piece weight, the drop in temperature to be achieved, and the change in enthalpy, or heat content, of the resin between those temperatures. This property of the resin is plotted in the graph of Fig. 4, p. 113. (Naturally, the heat content is also involved when doing any calculating of heat *inputs* to heating cylinders.)

As an example of the use of the chart, consider the cooling of one pound of polypropylene from 450° F., a likely stock temperature, to a mold release temperature (of the piece, not the mold) of 180° F. This requires that 250 − 60 = 190 B.t.u. be removed, about 12 B.t.u./oz. The more-or-less steep rise in the center region of each of these curves is the melting range, and the jump in heat content through this range is the heat required to melt the solid plastic, the heat of fusion.

Examination of Fig. 4 shows that the polypropylene curve does not resume its initial slope—indicating the completion of melting—until its temperature reaches about 380° F. Above this temperature, this resin exhibits the rapid exponential increase in fluidity with temperature characteristic of other polyolefins. It also exhibits their non-Newtonian flow behavior, as Fig. 5, left, shows. This is a logarithmic plot of shear rate versus shear stress—essentially flow rate in a melt indexer versus pressure drop, since all these measurements were made with the same orifice—at various temperatures for polypropylene and high-density polyethylene. The slopes of these plots are all the same, as far as can be told from the data, averaging 1.77. This means that tripling the pressure drop jumps the flow rate sevenfold. The rate of change of flow with temperature is usually expressed as an "activation energy" of flow. These data indicate an activation energy of about 12.3 kcal. for polypropylene, about 9.3 kcal. for high density polyethylene. In practical terms, this rapid rate of change of flow limits the molding range to *stock* temperatures between 450 to 525° F. At lower temperatures it will be difficult to fill the mold; at higher temperatures, on the other hand, there may be trouble with flashing.

Cylinder capacity down

Pro-fax has been stabilized against thermal degradation, but yields no corrosive products even if accidentally decomposed. Also, it does not absorb water, so no special drying or handling techniques are needed. No special materials of construction are required. Dry coloring is possible if the colorants used can withstand the higher processing temperatures involved. Suggested start-up molding conditions are given in Table II, left.

Polypropylene has the highest specific volume of all the present commercial thermoplastics, and its specific volume rises rapidly with rising temperature (see Fig. 6, p. 117). Compared with poly-

Table II: Suggested molding conditions for polypropylene

	Thickness of section		
	Less than 1/8 in.	*1/8 to 1/4 in.*	*Over 1/4 in.*
Cylinder temperatures[a], °F.			
Rear	475-600	450-525	450-525
Center	475-600	450-525	450-525
Front	425-550	400-475	400-475
Nozzle	400-500	400-500	400-500
Melt temperature, °F.	450-525	450-525	450-525
Mold surface temp., °F.	60-180	60-220	100-220
Ram pressure, p.s.i.			
Standard cylinder	10,000-30,000	8,000-30,000	8,000-30,000
Preplasticator	8,000-30,000	6,000-30,000	6,000-30,000
Approximate cycle, sec.			
Including mold open	15	30	60
Ram forward time	5	10	15

[a] These are recommended start-up temperatures, and final operating temperatures may be higher, depending on the application, machine, and cycle. The aim should be to reach a *melt* temperature within the recommended range that gives satisfactory operation.

styrene, its specific heat-rate of increase in heat content with temperature—is also high. These two factors combine to reduce the shooting and plasticating capacities of cylinders rated in terms of polystyrene. In a recent evaluation, using the method of rating plasticating capacity proposed by the S.P.I., a cylinder which was rated at 42 lb./hr. of G-P polystyrene would only melt 27.5 lb./hr. of polypropylene. This is not as serious as it sounds, since a smaller weight of polypropylene is needed to fill a given cavity than of polystyrene, and the effective reduction in volumetric plasticating capacity is about 21 per cent rather than 33 per cent. However, the difference is large enough to deserve consideration in choosing a machine for a job. As a rule, the rated capacity of a cylinder should be multiplied by a factor of ½ to ⅔ to get the effective weight rating for polypropylene. The factor used depends on the age and condition of the machine being considered.

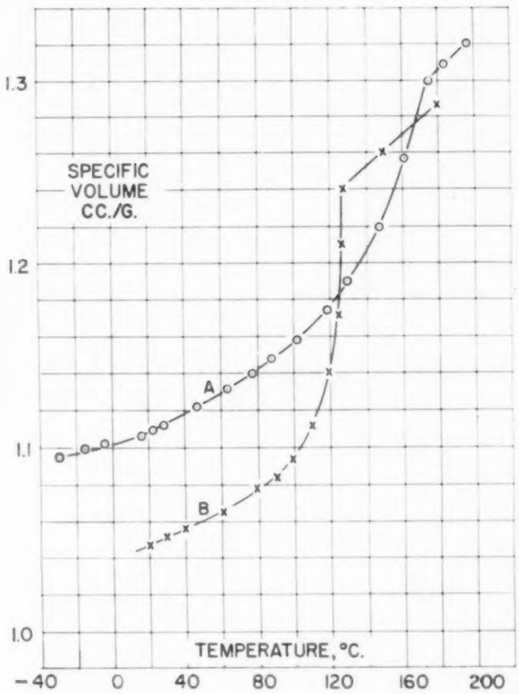
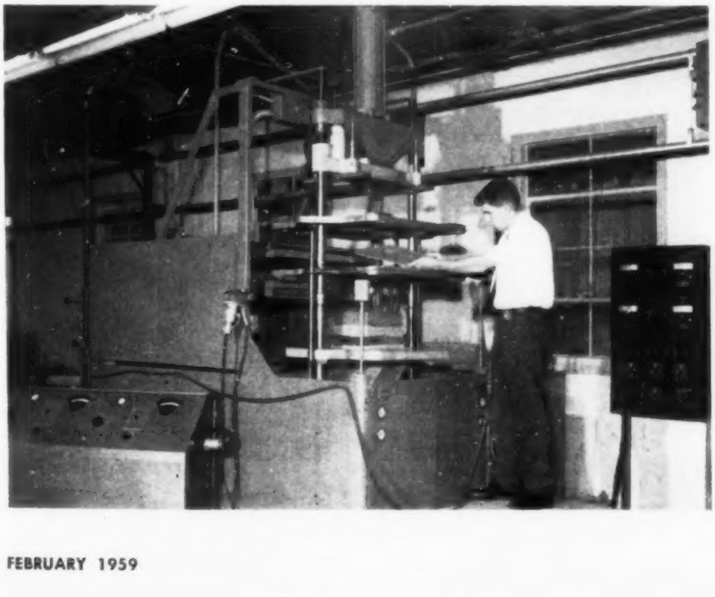


FIG. 6: Specific volume curves for polypropylene A and high-density polyethylene B follow same general pattern as heat-content curves.

Like other thermoplastics, polypropylene is best molded at high rates of filling, i. e., at high ram speeds and pressures. Whenever possible, full booster and high injection-ram speeds should be used to build up and maintain pressure at the extremities of the mold. The resin is also well suited to preplasticating machines, precompressed molding, and other means of achieving high pressure in the mold.

Mold temperatures can be somewhat lower for polypropylene than for many other polymers. Good surface finish can usually be achieved at mold temperatures of 60 to 100° F. if the melt temperature is reasonably high and the effective ram pressure is sufficient to insure smooth flow into the cavity. Mold shrinkage will decrease with lower cylinder and mold temperatures, with higher injection pressure, and longer ram-forward time.

FIG. 7: This sheet thermoforming machine provides either one- or two-side heating. It was used in making heating-time measurements on polyolefin sheets of various thicknesses.



SHEET THERMOFORMING

Because of a high degree of interest in sheet thermoforming of polypropylene and high-density polyethylene, we have investigated some of the conditions and techniques required to form good pieces from these resins. The materials tested were unpigmented Hi-fax polyethylene, (1600 type, density 0.945, MI=0.2), and unpigmented Pro-fax polypropylene. The machine used was the Emhart model shown in Fig. 7.

Heating cycles

Because of the high heat capacities of the polyolefins and because relatively high sheet temperatures are needed in forming these resins, sheet thermoformers have been apt to conclude that long heating times are needed and that sheets may sag excessively during heating. Rowe showed (see "Choosing and forming polyethylene sheet," MPL, Aug. 1958, p. 113) that if a heater of sufficient watt density were used—about twice the density

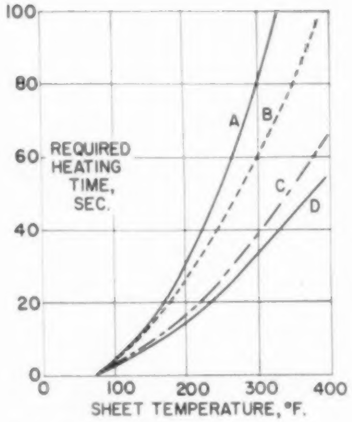


FIG. 8: Heating-time curves for ⅛-in. polyolefin sheets. A: high-density PE with top heater only at 1100° F., watt density 3.3 kw./sq. ft.; B: polypropylene at same condition; C: high-density PE with top and bottom heaters, top at 1100° F., bottom at 1025° F., total input 6.6 kw./sq. ft.; D: polypropylene, heated from both sides.

normally used in forming high-impact polystyrene sheet—high heating rates could be achieved.

The heat-content curves in Fig. 4, p. 113, which apply to injection molding, can also be used to make the same kinds of calculations for heating and cooling during thermoforming. By just such calculations, we arrived at Table III, right, which is a comparative statement of heat consumption during the three stages of heating sheets to the forming temperature. Since these resins are stiff and hard enough to be safely handled at temperatures up to 212° F., it is clear that the heating time *in the forming machine* can be reduced considerably by preheating the sheet outside the machine or by using still hot, freshly extruded sheet.

Cycles can also be shortened by heating the sheet from both sides, as every former knows. Fig. 8, above, gives the heating time required to raise ⅛-in. sheets to various temperatures, using a single heater over the sheet and a two-side heating. The watt density of the heater (at these temperatures) is about 3.3 kw./sq. ft.; the sheet is exposed to twice that when both heaters are used. The heater area was considerably larger than the sheet area; therefore, the edge effects are negligible.

Sheet temperatures are those given by a thermo-couple located in the midplane of the sheet, 1.5 in. in from one edge. The valves plotted here are averages of several test runs. These curves show that two-side heating cuts the heating time to about half that required when heating the top side only. (This would be expected of efficient radiant heating.)

Note also that with two-side heating, high-density polyethylene requires about 16% more heating time than polypropylene to reach a given sheet temperature. The heating time achieved with the upper heater only, about 0.65 sec./mil of sheet thickness, is considered economically sound. No adverse effects were encountered at either heating rate.

Plastics are notorious for their low thermal conductivities, and heating plastics by conduction is slow unless the area of contact with the hot surface can be made very large and the thickness small. Heating time by conduction goes up as the square of the sheet thickness, and decreases rather slowly as the temperature of the heating surface is raised. The same holds for *cooling* by conduction, and these laws govern the cooling of plastics in chilled metal molds.

Radiation, on the other hand, can be a relatively fast process in plastics, particularly those that are transparent enough to short infra-red so that the rays can penetrate into the sheet. In such circumstances heating time should be inversely proportional to the *fourth* power of the absolute temperature of the heater. Since doubling the sheet thickness only doubles the amount of material to be heated but does not seriously reduce penetration, heating time, at a given heater temperature, should be directly proportional to sheet thickness.

Combining these ideas, we should expect that with any particular heater arrangement and a given resin, the quantity $t/\Theta T^4$ will be constant if radiation is the dominant heat-transfer mechanism. In this expression, t = the sheet thickness, Θ = the heating time, and T = the absolute temperature. This test can be applied to the heating-time curves plotted in Fig. 9, p. 120, for polypropylene and high-density polyethylene of three sheet thicknesses. The values of this "radiant heating function" for all the temperatures and

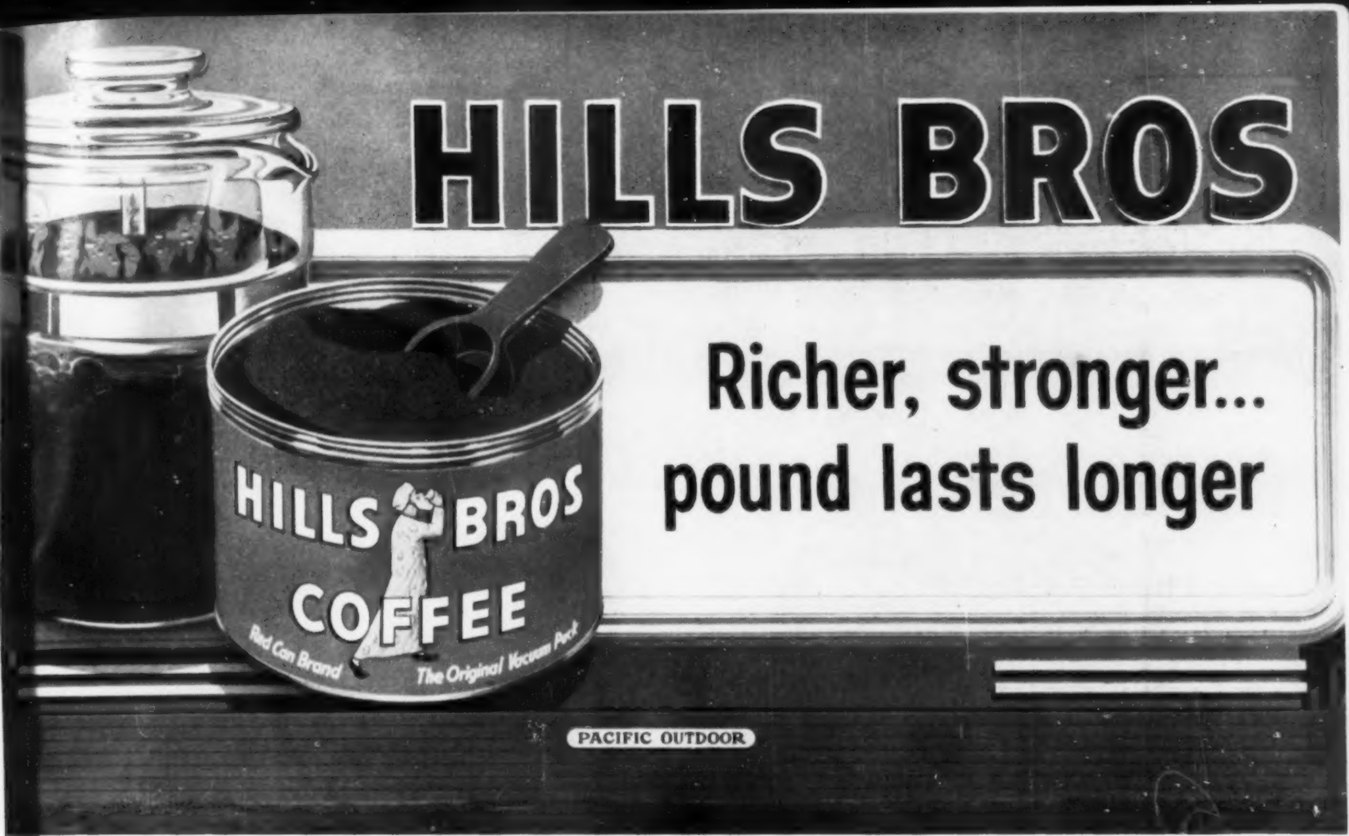
Table III: Percent total heat required to raise temperature

From	*To*	*High-density polyethylene (0.945)*	*Polypropylene*
Room temperature	100° C.	31%	39%
100° C	Transition point	46%	59%
Transition point	Typical forming temperature	23%	2%
		100%	100%

Table IV: Radiant heating functions[a]

Curve	*Sheet thickness, mils*	*Resin*	$10^{13} \times t/\theta T^4$, *mil/sec.,°R*^{4} *900°*	*1000°*	*1100°*	*1200°*	*Avg.*
A	125	PE	5.0	4.6	4.4	4.5	4.6
C	60	PE	4.5	4.4	4.5	4.8	4.6
E	20	PE	3.1	3.3	3.7	—	3.4
B	125	PP	5.4	5.6	5.7	5.4	5.5
D	60	PP	5.3	5.2	5.4	5.8	5.4
F	20	PP	4.3	4.7	4.4	—	4.5

[a]These values apply only to unpigmented sheet heated from both sides in this particular heater setup (watt density of heaters about 3.3 kw./sq. ft. at 1100°). Absolute temperatures were taken as the mean heater temperatures +459 (e.g., for 900°, T = 900 − 75/2 + 459 = 1322° R).



Letters faced with Tenite Butyrate withstand monthly relocating

PACIFIC OUTDOOR ADVERTISING COMPANY offers its clients monthly rotation of painted bulletins from site to site. This means that after initial erection the sign sections must be dismantled, moved and re-erected eleven times each year. To minimize the possibility of breakage during these changeovers, and because of its weatherability, sheet extruded of Tenite Butyrate plastic is used for the illuminated faces of the large metal-framed letters on the signs.

In addition to its outdoor durability, Tenite Butyrate's superior strength in relation to sheet thickness permits the use of lighter gauges in manufacturing —effecting appreciable savings in cost of materials.

Signs made of Tenite Butyrate offer excellent resistance to sun and weather. They are easy to clean and will retain their color and lustrous finish for years. Extruded sheet of this thermoplastic material, available in many transparent, translucent and opaque colors, is easily formed by the application of heat in combination with vacuum, air or mechanical pressure.

When decorating is desired, suitable lacquers may be applied, either to the sheet or to the formed sign, by brushing, spraying or silk-screening. The sheet may be cut, sawed, drilled or otherwise machined with ordinary hand or power tools used for machining wood or metal.

The weather resistance of Tenite Butyrate makes it ideal for many outdoor applications. For more information on this tough, easy-to-form plastic, write to EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENN.

The large letters on Pacific Outdoor Advertising Company's painted bulletins are fabricated by Electrical Products Corp. of Los Angeles. Metal-framed letters, illuminated by double-tube Zeon red neon, are faced with sheet of Tenite Butyrate extruded by Jet Specialties Company of Los Angeles. The sheet, which is dimpled, provides a highly reflective surface from every viewing angle.

TENITE BUTYRATE
an Eastman plastic

Information regarding Tenite also can be obtained from local representatives listed under "Plastics —Tenite" in the classified telephone directories of the following cities: Atlanta, Chicago, Cleveland, Dayton, Detroit, Houston, Kansas City, Leominster (Mass.), Los Angeles, New York City, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, Seattle and Toronto—elsewhere throughout the world, from Eastman Kodak Company affiliates and distributors.

thicknesses are listed in Table IV, p. 118. Except for a slight drop-off at the 20-mil thickness, they strongly confirm the hypothesis that the infra-red rays penetrate even into the ⅛-inch-thick sheet. These sheets were not especially shielded against normal drafts and convection, and greater heat losses from the very thin sheet could easily raise its heating times slightly.

By consulting the enthalpy chart again, it is possible to calculate the rate at which the sheet is taking up heat. For ⅛-in.-thick polypropylene at a heater temperature of 1100° F., assuming it is heated to 350° F., this works out to be 2.6 kw./sq. ft., or is about 40% of the heater output. This efficiency is about the same over the whole heater-temperature range, since both output and take-up are proportional to T^4.

Obviously anything that interferes with radiant energy penetration into the sheet, e.g., pigments or opaque overlays, will reduce the heating rate. The magnitude of this reduction depends on the opacity (to infra-red) of the interfering agent and on the thickness of the sheet. In extreme cases, heater output may have to be cut back and the heating cycles may be several times the cycle required for "natural" sheet.

Sheet temperatures at the time of forming should be in the range from 300 to 370° F. for high-density polyethylene, about 330 to 350° F. for polypropylene. The forming temperature in any one case depends on complexity and detail of mold, depth of draw, and mold temperature. For quality products, uniformity of heating over the sheet is important. This is most easily accomplished by bringing the heater as close to the sheet as is possible without inducing a heater-rod pattern in the sheet.

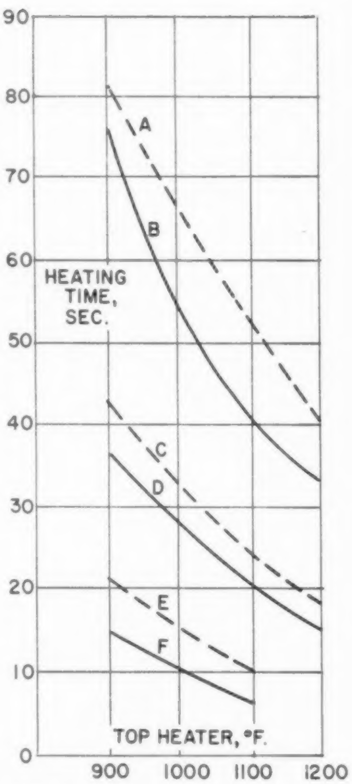


FIG. 9: Heating time required for various thicknesses of polyolefin sheets heated from both sides (bottom heater temperature 75° F. less than top). Dashed curves A, C, E are for high-density polyethylene of 125, 60, and 20 mils thickness; curves B, D, F are for polypropylene of same thicknesses. Note that heating time is almost in direct proportion to sheet thickness.

Forming techniques

Properly handled, polyolefins are readily formed by use of vacuum to pull heated sheet over or into a wide variety of male and female molds. They have been formed on molds made from a variety of materials—wood, epoxy, phenolics, sprayed metal, formed steel, plaster of Paris. For short-time experimental runs, all of these materials have proven satisfactory. However, for any sustained production runs, molds should be of machined or cast aluminum or other durable metals that conduct heat well, and they should be cored for circulation of water at controlled temperatures.

A highly polished mold surface is not required but should present no problem when used if vacuum holes are properly spaced to relieve air that may become entrapped between the mold and sheet. Vapor-honing or sandblasting of the mold surfaces helps to prevent the sheet from sticking to the mold or trapping air, yet gives a smooth, glossy surface on the finished part.

No critical value can be assigned to the size of the vacuum holes. They should be small enough not to reproduce on the molded surface yet large enough to insure adequate air evacuation. A #80 drill (13.5 mils) has proved satisfactory in most cases. Larger vacuum holes—up to 30 mils diameter—may be used where 60-mil and thicker sheets are being formed and where the sheet temperature is in the lower forming range. Many small holes give better results than a few larger ones. Vacuum holes should be numerous in low areas, at least 1 to 2 holes per sq. in. along deep radii, with an increasing number of holes in areas of more complex contour.

Although polyolefins can be formed into sharp angles without excessive thinning, radii of molds should always be as generous as possible. A good rule of thumb for specifying mold radii is that edge radii should be 3 to 4 times the average thickness of finished part and corner radii should be twice that figure.

Male molds require drafts of 2° or more because of shrinkage and the tendency of the material to shrink onto the mold. For rough or patterned surfaces, greater drafts may be required. Female molds, on the other hand, will require less than ½° draft as material will shrink *away* from the mold. In any case, draft should be great enough so as not to require excessive blowing of the piece off the mold.

Straight vacuum forming is recommended where feasible, but should not be used where the depth of draw exceeds one half the smallest distance across any opening. Deeper-draw parts should be drape formed using an increased frame area to give thicker edge sections for greater strength. Maximum edge thickness is obtained with a female mold while maximum center thickness is obtained with a male mold.

When using the plug assist with straight female molds, the rate at which the plug forces the material into the cavity should be slow, especially in deep-draw forming of large parts. A plug that is capable of being accurately heated to 50 to 100° F. below the

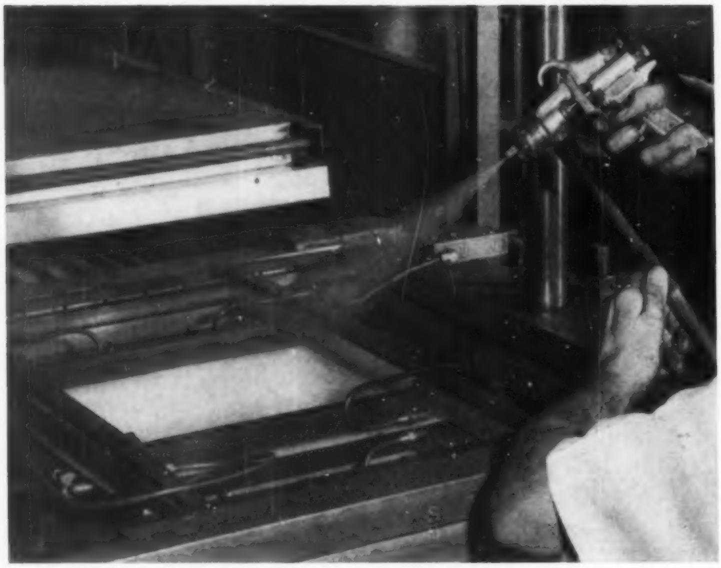


FIG. 10: Applying water mist to freshly formed tray to hasten the cooling and to reduce the shrinkage

sheet stock temperature should yield walls and bottoms of more uniform wall thickness and should reduce the tendency of the plug contact to cause "chill marks." In general, the sheet should be cooled as little as possible when in contact with the plug.

For maximum uniformity and minimum postforming warpage, mold temperatures in the range of 180 to 200° F. have thus far produced best results with high-density polyethylene. Slightly lower mold temperatures, 160 to 180° F., are suggested for polypropylene.

Shrinkage

All thermoplastic sheets shrink after being formed, the amount depending on thermal aspects of the molding process. Polyolefins offer no exception here. Mold design should allow for mold shrinkage of the finished part. Mold shrinkage has been found to be dependent upon 1) extrusion conditions of the sheet stock, i.e., draw-down or orientation, 2) mold temperature during the forming process, and 3) method and time of cooling of the formed part in the mold.

Some thermoplastic sheet materials are oriented during the extrusion process and may require more careful handling in vacuum forming because of the shrinkage (elastic memory) upon heating. When the shrinkages in the extrusion and transverse directions are unequal, they should be treated separately in estimating final shrinkage in the formed part. High-density polyethylene sheet with estimated *extrusion* draw-down of 10% has shown mold shrinkage of 4% in regions of less than 10% *forming* draw-down and as much as 8% in regions of 30 to 40% *forming* draw-down when measured in a direction corresponding to the extrusion direction of the original sheet stock. Measurements of shrinkage in these same areas on the formed part in a direction corresponding to the transverse direction of the extruded sheet yielded smaller shrinkage values (1.5 to 2.5 per cent). No general recommendations for estimating mold shrinkage based on draw-down during sheet extrusion can be made at the present time. Properly extruded, polyolefin sheet stock should be relatively free from orientation.

An increase in mold temperature has the adverse effect of increasing shrinkage slightly. Table V, below, shows the effect of mold temperature on mold shrinkage (transverse-extrusion direction) of high-density polyethylene and polypropylene. As might be expected, the shrinkage was greatest in those areas of greatest draw-down during forming.

Table V: Effect of mold temperature on shrinkage of formed[a] polypropylene and high-density polyethylene

Mold temperature	% Shrinkage[b]			
	Areas of 10% forming draw-down		Areas of 30-40% forming draw-down	
°F.	High-density polyethylene	Polypropylene	High-density polyethylene	Polypropylene
120	0.25	0.25	2.0	1.7
160	0.50	0.25	2.0	1.7
200	1.20	0.75	2.5	2.0

[a] Drape assist vacuum forming. Specimen 9 × 12 × 2 in. pan

[b] Shrinkage measurement taken in a direction corresponding to across extrusion direction of original sheet

Cooling the formed sheet

Rigid polyolefins should be cooled to at least 180 to 200° F. before removal from the mold. This minimizes warpage and post-shrinkage. There seems to be no basis for specifying a cooling time as a percentage of the heating time. The correct cooling time should be the minimum time required to produce a suitably rigid piece, free from warpage and with minimum shrinkage. An example: 60-mil polypropylene was cooled in 15 sec. after being heated for 28 sec. from both sides with the top heater at 1000° F. Mold temperature was 120° F.

The method of cooling not only affects cooling time, but also shrinkage. Generally, the fastest cooling at a given mold temperature gives the least shrinkage. A fog spray is recommended over straight air cooling because heat is taken out of the piece faster by evaporation of water than by convective air cooling. The spray is applied immediately after the sheet is drawn down into the mold, as in Fig. 10, above.—END

PTFE bearing materials

Chemically inert polytetrafluoroethylene compounds have low coefficients of friction, can give long service if properly designed for load and speed

A material which has long been famous for its slipperiness is Teflon tetrafluoroethylene resin (PTFE). This property of slipperiness, together with chemical inertness, wide operating temperature range, and excellent electrical insulating qualities has made PTFE a likely candidate for difficult anti-frictional applications. Because it is naturally slippery, it needs no oil in many uses, though lubrication enhances its performance in bearings. It enjoys long life in chemicals that rapidly corrode the ruggedest of bearing metals. Relatively soft, PTFE can assimilate abrasive particles that would ruin hardened steel balls. Flexible, it will accommodate itself to the mating surface. For these reasons PTFE is finding use as a bearing material in the following areas:

1) Near substances that must not be contaminated, e.g., textiles, papers, tobacco, foods, and drugs.

2) Where immersed in non-lubricating liquids such as gasoline, or in liquids that corrode most other materials.

3) At the −320° F. temperature of liquid oxygen where oils are useless as lubricants.

4) At elevated temperatures up to 500° F. where common lubricants will degrade or vaporize.

5) At low humidities where other types of dry bearings that depend on moisture for their lubrication properties cannot be used, and at high humidities that accelerate metal corrosion.

6) In heavily loaded, slow-speed bearings that tend to squeeze oil out of the bearing interface, and in areas where there is danger of fretting or galling.

7) In lubricated bearings that tend to fail during start-up by seizing before a moving oil film can be established.

8) Where slip-stick motion is mechanically undesirable or where it causes vibration and/or noise.

9) Where the lowest possible static friction is desirable, as in reciprocating and oscillating systems.

10) Where the bearing is located in an area that is inaccessible or likely to be neglected.

11) Where space or weight savings are important.

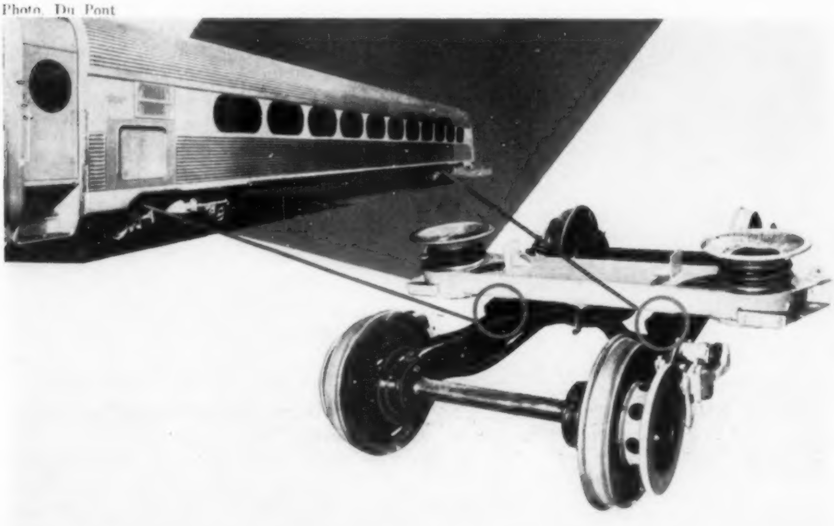
12) Where liquid lubricants pick up abrasive dust.

The very low static coefficients of friction typical of TFE resin —even lower than its dynamic coefficients—are often taken advantage of in applications where there is frequent starting and stopping. Table I, p. 124, contains some recent values of static coefficients of tetrafluoroethylene and other bearing materials, reported by Weiter and Schmidt (1).[1]

The very softness and flexibility of PTFE impose serious limitations on its use under heavy loads: it tends to creep. Because of this creep a bearing can get out of shape, loosen, or even flow out of the journal. For this reason many inert mineral fillers for PTFE have been tried in an effort to reduce the creep and wear rates without sacrificing the desirable

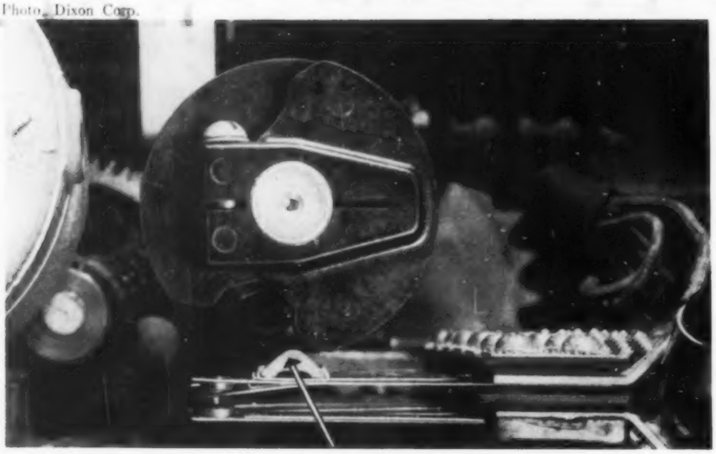
[1] Numbers in parentheses link with references listed at the end of this article.

Photo, Du Pont



TWO PTFE bearings (circled) on each truck of the railroad car increase the safety of this high-speed train. The low friction of the resin permits the truck to steer out of the curve with a minimum tendency to climb the rail. These bearings have shown no sign of wear in over 120,000 miles of use.

Photo, Dixon Corp.



FILLED-PTFE cam follower (arrow) helps to make and break contacts in selector stopping switch.

properties of the pure resin. That these attempts have met with some success is proved by the acceptance of filled Teflons for certain applications where the pure resin had failed in creep. Unfortunately, the only quantitative data available on the creep behavior of filled PTFE is given in the Teflon engineering data book (2). These data indicate that, over a 100-hr. period, creep rate is slowed by five-fold or more by the addition of 15 to 25% glass fiber. It is probable the filled-PTFE compositions offered by Dixon Corp., Bristol, R. I., under the trademark Rulon contain glass or other ceramic fibers, and so can be expected to have much lower creep rates than pure tetrafluoroethylene.

Heat is the enemy

Heat is generated in any journal bearing at the rubbing interface, and is probably the basic cause of most bearing wear and failure. The rate of heat generation is proportional to the coefficient of friction, to the lineal surface speed, as well as to the bearing pressure.

Bearing pressure is defined as the applied load divided by the projected area, and the product of this pressure in p.s.i., times the surface speed in ft./min., is called the PV value for the bearing at those service conditions. PV value is therefore a direct measure, for a given coefficient of friction, of the heat generation rate.

If none of the frictional heat could escape, the bearing temperature would rise until the bearing melted or decomposed. However, some escapes by conduction through the bearing to its supports; some escapes through the mating member, usually a metal part; some reaches the surrounding air (or liquid) by radiation and convection. A great deal of cooling can be accomplished by bathing the bearing interface with a steady stream of cooled lubricant. With tetrafluoroethylene, however, an important reason for selecting the material is that it can be run dry.

Of course, its low coefficient of friction helps reduce the amount of heat. Whatever the application, the frictional heat must be carried away as fast as it is generated without the interface temperature exceeding some critical limit above which the surface wears rapidly.

Even though PTFE has outstanding heat resistance, its hardness, elastic modulus, strength, and creep resistance all decrease as the temperature rises. At PV values of 1000 or more, dry PTFE bearings wear very rapidly, and Du Pont workers recommend (3) that the unmodified material be operated at PVs below 1000. The work of White (4) indicates that even lower values are advisable for the pure resin if long life with low wear is wanted. Some idea of what a PV of 1000 means may be gained from this example: a bearing 1 in. long (of any diameter) would be operating at PV = 1000 if the shaft were turning at 100 r.p.m. and the load were 38 lb., or 1000 r.p.m. and 3.8 lb., etc. The bearing pressure limit that is recommended by the Dixon Corp. for molded Rulons A, B, and C, running dry, is 5000.

Bearing friction and wear

A number of workers have measured the coefficient of friction of PTFE under various conditions. Their reports, up through mid-1955, are listed in (3). Ricklin and Miller (5) made the first study

Table I: Static coefficients[a] of friction of bearing materials, data by Weiter and Schmidt (1)

Material A → / *Material B* ↓	*Ground cast iron 20 μ-in. RMS 50-lb. load*	*Scraped cast iron 20 contact points per sq. in. 50-lb. load*	*Ground steel 20 μ-in. RMS 50-lb. load*
PTFE, dry	0.079	0.070	0.087
lub.	0.046	0.098	0.079
PTFE + graphite, dry	0.076	0.130	0.110
lub.	0.075	0.084	0.087
PTFE + glass, dry	0.148	0.091	0.140
lub.	0.090	0.094	0.095
Bearing bronze, dry	0.260	0.250	[b]
lub.	0.150	0.211	0.098
Cast iron, dry	0.350	0.202	[b]
lub.	0.142	0.30	0.123

[a] Time at rest before each test: 1 min.
[b] Coefficient increased on successive tests.

Table II: Friction and wear of PTFE bearing materials, data of Ricklin and Miller[a]

No. Bearing material	*Radial wear at PV = 2450 hr./mil*	*Coefficient of friction at PV = 2450* New	*Coefficient of friction at PV = 2450* Worn
1 PTFE (molded Teflon 1)	Too worn to measure	0.19-0.23	0.26
2 66 nylon, molded	25	0.36-0.38	0.36-0.72
3 66 nylon, sintered	23	0.40	—
4 Polyethylene, density 0.92	Too worn to measure	0.73	—
5 Textolite 2001[b]	119	0.24	0.43
6 PTFE + 25% mica	178	0.28	—
7 PTFE + 40% bronze	214	0.27	0.24
8 PTFE + 40% lead	340	0.23	0.25
9 PTFE + 40% graphite	140	0.19	0.19
10 PTFE + 25% glass fiber	214	0.26	0.23
11 PTFE + 85% copper	107	0.26	—
12 PTFE + 20% glass fiber + 20% molybdenum disulfide	630	0.17	—
13 Rulon A[c]	220-560	0.16-0.20	0.19-0.25
14 Rulon B[c]	510-820	0.18-0.22	0.17-0.19
15 Rulon C[c]	670-1070	0.16-0.18	0.15-0.17

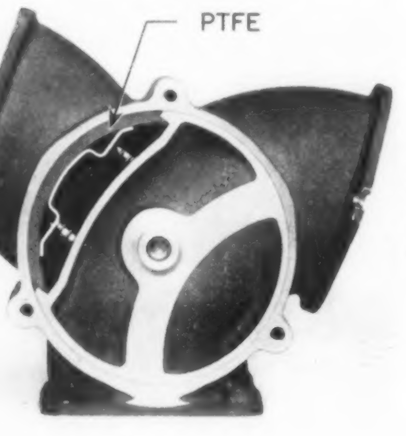
[a] Bearings were run on a ½-in. hollow shaft made of hardened drill rod and maintained at 100° F. Shaft speed was 156 r.p.m., bearing pressure was 120 p.s.i.
[b] Textolite 2001 is a phenolic laminate containing finely woven cotton cloth and graphite made by General Electric Co.
[c] Rulon values represent ranges obtained with from 10 to 40 bearings.

of the wear of PTFE compounds (and some other materials) in journal bearings operating at a high PV value. Their results (including some others reported to the editor privately by Mr. Miller) are given in Table 2, above. A very extensive investigation of PTFE bearing materials was reported by White (4), and Table 3, p. 128, is a selection of some of his results. White also found that the coefficients of friction of dry PTFE bearings vary with such factors as 1) ambient temperature, 2) clearance between bearing and shaft, 3) surface speed, 4) shaft material, and 5) length of test. His work shows that while wear rates are usually higher at higher PVs, there are occasional reversals. Even when test conditions are carefully reproduced, wear rates vary considerably (see items 17 through 22, Table 3, and items 13, 14, and 15, Table 2. Also, little can be concluded from wear tests at one set of conditions about what results may be expected at another, as a glance at items 7, 8, and 9 of Table 3 will show. The last four items of Table 3 show that wear rate is strongly influenced by the shaft material, and it is likely that bearing life will be longer if the metal and plastic surfaces are smooth. The recent Du Pont bulletin on PTFE bearings (1) recommends finishes of 35 to 50 μ-in. for the resin, 14 to 16 μ-in. for the shaft.

In view of the many factors influencing wear rates in these materials, the wise designer will probably want to test sample bearings at the expected service conditions, when wear is a critical factor, before making a production run.

A new form of PTFE for bearings is made up of powdered resin and mineral filler. It can be pressed and sintered into the desired shape or bearings; can be machined from available standard shapes. Called Fluorosint by its makers, The Polymer Corp., Reading, Pa., this material is somewhat porous and has good dimensional stability. Its creep resistance is about three times that of pure molded PTFE, its coefficient of thermal expansion is only one-sixth as great, but it is also only half as strong as the pure resin. It is reported to have been run at PVs up to 15,000 with wear rates less than 0.1 mil/hr.

Photos, Dixon Corp.



BOTH CHEMICAL and frictional properties of filled PTFE come into play in this slider for three-way diverting valve.

Make them thin

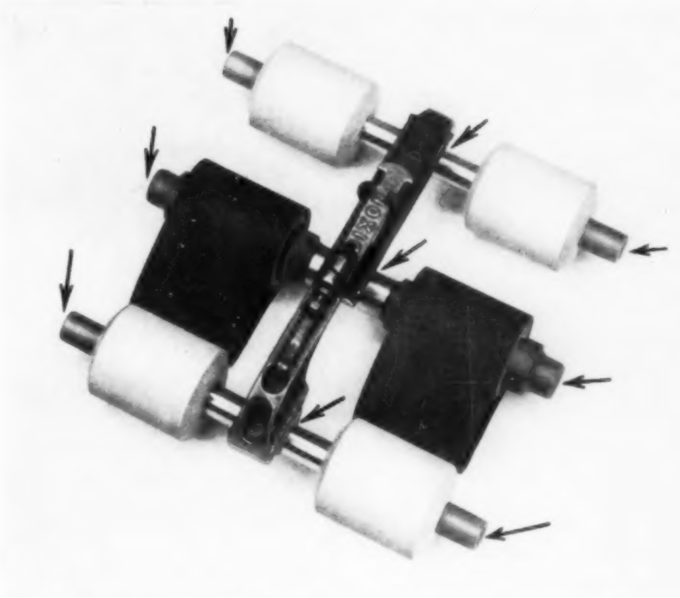
The very low thermal conductivity of PTFE is a serious obstacle to the escape of heat from the frictional surface. A good practice is to make the resin sleeve as thin as practicable. These compounds cannot be molded in very thin cylindrical sections (though the new injection-moldable FEP resin may soon change this situation), but there is no doubt that many PTFE bearings have been made thicker than they needed to be. A thin resin sleeve offers other advan-

tages, too: lower material cost, reduction of thermal expansion effects (which can cause the bearing to seize), less creep under load, and, often, a more compact design.

Along these lines, an interesting new way of building PTFE bearings has been made possible by the discovery of the sodium-ammonia treatment that makes the resin bondable with epoxy adhesives. Bond strengths of about 300 p.s.i. (tensile shear) are possible, making it practical to bond PTFE tape to the insides of metal sleeves. The lined sleeve serves in place of a solid PTFE molded bearing, has much better heat dissipating capacity, and can stand higher PV loadings. With the Rulon materials, for instance, the PV limit jumps from 5000 for the bulk material to 10,000 for metal-backed tape. These T-liner bearings are available in 10 standard sizes from 0.25 to 1.25 in. in inside diameter.

Carrying the same approach a step further are the Rulon S-liner materials, in which the PTFE compound is impregnated into a 60-mesh screen matrix. The thickness of plastic above the wire (on one or both faces) is about 6 mils. This construction gives faster heat dissipation than any other so far developed with these resins, has as good frictional properties as the bulk compounds, and can be run continuously at PV values up to 20,000 (dry). These S-liners can be backed up by die-cast metal, fitted into rolled bushings, bonded to sheets, etc. Creep is practically eliminated.

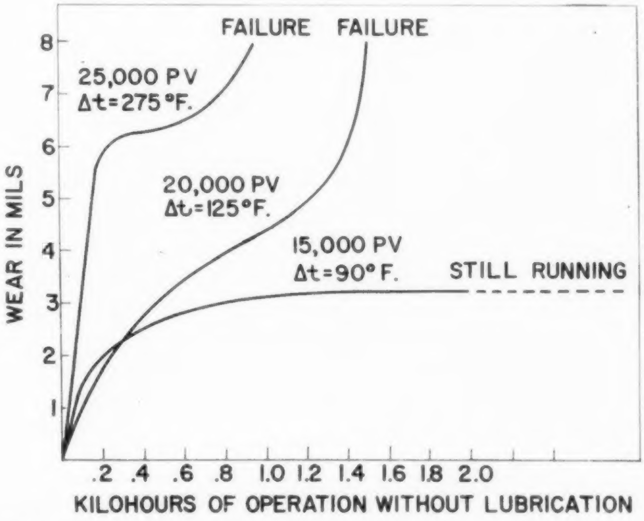
The graph at right shows how the wear of S-liners varies with operating time at various PV values. Note that the temperature rise above room temperature was only 90° F. at PV = 15,000, the highest value at which the bearing might be expected to run indefinitely. It is possible that some surface temperature near 160°F. (90° + 70°) is a top limit above which PTFE bearings cannot be expected to have long life. A corollary to that proposition is this: if the frictional surface could be kept below this temperature (by blowing air through the journal, internally cooling the shaft, etc.) perhaps long bearing life could be achieved at much higher PV values than are now thought possible.



TEXTILE DRAFTING ROLLS in which nine bearing surfaces (arrows) are made of filled PTFE requiring no oil. Oil collects dirt, soils material in process. In average size mill there would be about 150,000 bearings.

A third new PTFE-based bearing material, known as DU, also offers superior creep resistance and heat dissipating ability. DU was developed in Britain, is marketed in the U. S. (under patents) by U. S. Gasket Co. It consists of a tin-plated steel backing onto which is sintered a thin lining of spherical bronze particles. These are impregnated with a mixture of 80% tetrafluoroethylene and 20% lead, and a thin skin of the mixture forms the working surface.

DU is reported to have a compressive yield strength (at room temperature) of 46,000 p.s.i., a coefficient of expansion about one-eighth that of pure PTFE, a coefficient of friction of from 0.10 to 0.16 at working PV levels, and a thermal conductivity of about



WEAR at surfaces of S-liner bearings. These bearings were ½ in. in diameter by ¼ in. long; S-liners were epoxy-adhered to metal sleeves, sleeves mounted in housings. Test shafts were steel dowel pin, Rockwell 64C, finish 6 μin. RMS, turning at 1725 r.p.m.

Table III: Friction and wear of PTFE bearing materials, data of White (4)

No.	Bearing material	Shaft metal	Approximate hr./mil of radial wear[a] ¼-in. shafts, 2000-g. load. 15 r.p.m. (PV=35)	150 r.p.m. (PV=350)	700 r.p.m. (PV=1630)	1800 r.p.m. (PV=4200)	Length of test at 150 r.p.m. hr.	Coefficient of friction at 25° C. with ¼-in. 410 stainless-steel shafts, 643-g. load. 15 r.p.m. (PV=11.2)	300 r.p.m. (PV=223)
1	Molded PTFE	303 Stainless steel	—	18	—	—	53	0.13-0.18	0.25-0.26
2	Molded polytrifluorochloroethylene (PTFCE)	"	268	23	—	—	31	0.26-0.28	0.29-0.45
3	Rulon A	"	19,100	2540	—	—	332	0.21	0.26-0.32
4	Rulon B	"	17,700	17,700	—	—	331	0.13	0.17
5	Rulon C	"	20,000+	2400	1024	344	602	0.19	0.22
6	Rulon D	"	20,000+	9960	1660	622	599	0.15	0.20
7	Rulon E	"	16,600	7120	2490	—	600	0.18	0.22
8	Rulon F	"	4140	5520	8300	1350	331	0.16	0.25
9	PTFE + 20% graphite[c]	"	9140	2440	—	—	332	0.15	0.21
10	PTFE + 50% copper powder[c]	"	446	182	—	—	438	0.16	0.22
11	PTFE + 15% molybdenum disulfide (MoS_2)[c]	"	6100	96	—	—	166	0.18	0.28
12	PTFE + 61% MoS_2	"	3640	364	—	—	525	0.28	0.31
13	PTFE + 25% glass and 3% MoS_2[c]	"	11,600	722	268	—	169	0.13	0.18
14	PTFCE + 56% PTFE, fused at 500° F.	"	2280	1740	2280	244	385	0.22	0.26
15	PTFCE + 51% PTFE + 10% glass, fused at 500° F., 13,000 p.s.i.	"	5220	2800	430	—	315	0.26	0.26
16	PTFE + 70% Mo + 6% chromium tetrahydrate	"	20,000+	326	—	—	335	0.31	0.33
17	PTFCE + 40% PTFE, fused at 500° F.	"	—	366	—	—	700		
18	"	"	—	202	—	—	1500		
19	"	"	—	214	—	—	700	0.11[b]	0.27[b]
20	"	"	—	159	—	—	1500		
21	"	"	—	304	—	—	700		
22	"	"	—	202	—	—	1500		
23	PTFE + 63% Mo powder (0.5 to 5μ)	"	—	5360	—	19	476		
24	"	440 C chrome steel	—	332	—	302	600		
25	"	D3 high-chrome tool steel	—	750	—	248	312	0.13[b]	0.19[b]
26	"	C40 cobalt chrome-nickel alloy	—	20,000+	—	4	310		

[a] Calculated from weight loss; bearing load was 2000 g.
[b] Load was 2200 g. in these tests, making PV values 3.42 times those given at tops of columns.
[c] U. S. Gasket Co. Chemelec compositions.

300 B.t.u./hr., sq. ft., (°F./in.)—over 100 times that of PTFE; these properties lead to excellent wearing qualities. For example, the recommended top operating pressure on dry, rotating sleeve bearings, for 10,000-hr. life, is 250 p.s.i. at 500 r.p.m. These conditions correspond to PVs in the range of 6000 for 0.2-in.-diam. shafts to 10 times that for 2-in. shafts. (PN, rather than PV, seems to be an operating constant for this material.) DU is available in three forms: flat strips, cylindrical bushings, and circular thrust washers, as well as in a variety of sizes. They were described in considerable detail in Reference 6.

References

1. E. J. Weiter and A. O. Schmidt, quoted in "Engineering facts about Teflon, No. 6—Bearings," E. I. du Pont de Nemours & Co., Wilmington, Del. (1958).

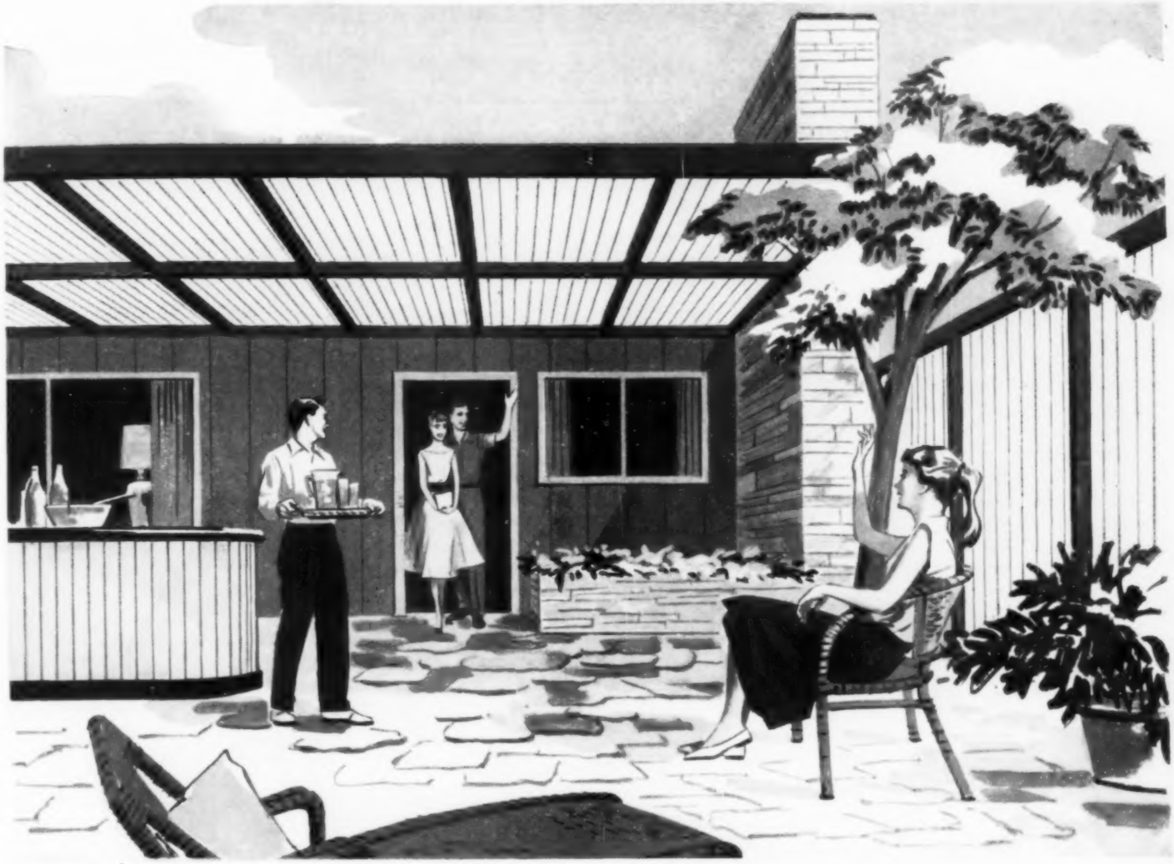
2. "Teflon tetrafluoroethylene resin—design and engineering data," E. I. du Pont de Nemours & Co., Wilmington, Del. (c. 1956).

3. A. J. Cheney, Jr., W. B. Happoldt, and K. G. Swayne, "Zytel and Teflon resins as bearing materials," Plas. Tech. 2, 221, 314 (Apr. and May 1956).

4. H. S. White, "Small oil-free bearings," J. Res. Nat. Bur. Stds. 57, 185 (Oct. 1956).

5. S. Ricklin and R. R. Miller, "Filled Teflon for dry bearings," Mat. and Meth. *40*, 112 (Oct. 1954). See also "Dixon Data" #38, published by the Dixon Corp., Bristol, R. I.

6. R. E. Harmon, "New dry bearing," Mach. Des. *30*, 22 (July 24, 1958).—END



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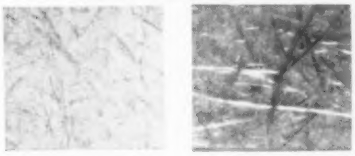


GLIDPOL 1001-LS — Resin "A"

Photograph (reduced to one-half actual size) taken after 24 months exposure to Florida sun shows little change in reinforced panel containing GLIDPOL 1001-LS diluted with Methyl Methacrylate. Marked discoloration, surface erosion and fiber blooming resulted when panel made with Resin "A" — diluted with Styrene only—was exposed same length of time.

QUALITY PRODUCTS

GLIDPOL POLYESTER RESINS
The Glidden Company • Industrial Paint Division
900 Union Commerce Bldg., Cleveland 14, Ohio

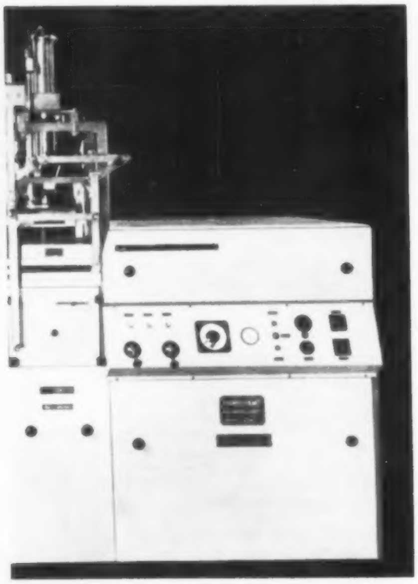
San Francisco • Los Angeles • Chicago (Nubian Division—1855 North Leclaire Avenue) • Minneapolis • St. Louis • New Orleans
Cleveland • Atlanta • Reading • Canada: Toronto and Montreal

MACHINERY AND EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

Small sheet former

Designed especially for laboratory work or short production runs, the new Formvac Junior machine is equipped for deep drawing, drape forming, airslip forming, and drop forming. Sheets are fed by hand and the clamp frame and heater are also operated manually. The forming operation and the return of the mold table and plug to the starting position are push-button controlled. The following figures are maximums: forming area, 10 by 12 in.; forming depth on female mold, 8 in.—on male mold, 6 in.; sheet thickness, 3/16 inch. Vacuum pump, vacuum surge tank, compressed air tank and compressor are built in. Heating is accomplished by a 1.5 kw. primary heater above the sheet and a reflector below. Vacuum surge tank and compressed air tank each have a volume of 29 gal.; vacuum pump motor is 3/4 hp.; compressor motor is 2 hp. Overall dimensions of machine are: length, 51 in.; depth, 40 in.; height, 91 inches. Made in Switzerland by Hydro-Chemie Ltd. Sold and serviced in the U. S. by *Conapac Corp., 120 E. 13 St., New York 3, N. Y.*



HYDRO-CHEMIE Formvac Junior, designed for laboratory work and short run production, is equipped for deep drawing, drape forming, airslip forming, as well as drop forming.

Mold adapter

Users of all Hornet model Mini-Jector injection molding machines now may increase the versatility of their machines with a new mold adapter which enables them to use not only the standard larger Hornet molds, but also the smaller Wasp V molds. (See MPL, Oct. 1957, p. 199.) The mold adapter can be installed or removed in a few minutes. A manual knock-out mechanism is standard equipment; an air ejector for the mold is optional. *Newbury Industries, Inc., Newbury, Ohio.*

Hot stamper

The Model 2AH stamping machine has two marking heads, is driven by a variable-speed motor, and uses an improved dial-feeding system. Color, pressure, temperature, and dwell of the two heads are all independently controlled. Each head is self-leveling. The stamper is handfed, but may be automatically fed if parts lend themselves to automatic positioning. With 20 stations on the dial feed, up to 4500 parts per hour may be marked. *The Acromark Co., 5-15 Morrell St., Elizabeth, N. J.*

Core chuck

Cores on which web-fed materials are wound can be prevented from loosening or slipping on the shaft by a new self-tightening core chuck which has no threads to jam or slip. In use, two eccentric ribbed chucks are slipped into the ends of the web core where they engage two eccentric lock rings secured to the shaft. Holding action is increased as tension on the core is increased; a reverse twist releases the chuck. Set of two chucks for 3-in. cores, $30. *Stanford Engineering Co., Salem, Ill.*

Finishing creams

Microlyte and Hi-Glos are creams for barrel finishing plastics. The creams are used in sequence and in combination with soft tumbling media—wood pegs, sawdust, or cob-dust. The parts to be polished are first placed in a barrel with about three times their weight of media and a small amount of Microlyte, then tumbled for 16 to 18 hours. Parts are then loaded into second barrel and tumbled for half an hour with new media impregnated with Hi-Glos to produce final high polish. These creams cost about $7/gal., depending on quantity. *H. W. Kramer Co., Inc., 120-30 Jamaica Ave., Richmond Hill 18, N. Y.*

High-speed gel coater

Reinforced plastics fabrication can be speeded up by the use of a new high-speed gel coater capable of applying, for example, a 0.020-in. thick polyester gel coat to a 14-ft. boat hull mold in 3 minutes. When required, the speed of operation can be reduced. The new system consists of two containers, one for catalyzed and one for promoted material, two pumping systems, pressure regulators, water trap, and a special two-headed gun. Cleaning is simple and the solvent used is saved and mixed as a diluent into the next following gel coat. Price: $1100. *Hupp Engineering Assoc., P. O. Box 3290, Sarasota, Fla.*

Hopper-dryer

Complete and self-contained, a hopper-dryer for use on injection molding machines up to 4-oz. capacity can be provided with (*To page 132*)

THORESON-McCOSH hopper-dryer can be supplied with adaptor to fit practically all injection machines up to 4-oz. capacity.

*Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

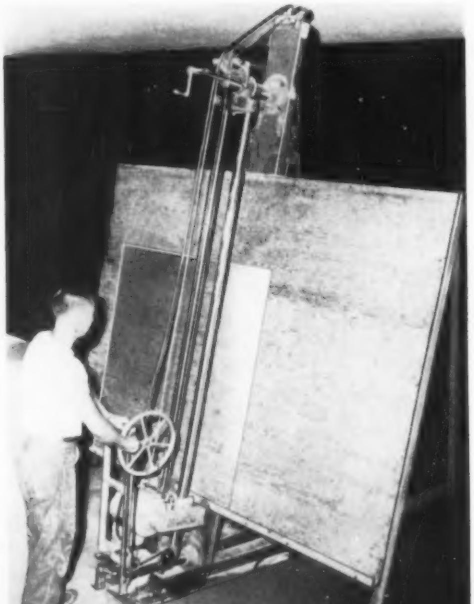
a hopper adaptor to fit almost any small machine on the market. It is thermostatically controlled and is available for operation on 110 or 220 v. single-phase 60 cycles, or 440 v. three-phase 60 cycles. *Thoreson-McCosh, Inc., 18208 W. McNichols Rd., Detroit 19, Mich.*

Continuous blender

Dry materials can be accurately proportioned, mixed, and blended, or liquids can be blended with solids in precise ratios with a new continuous blender, called Verticone. Materials to be blended are fed in predetermined proportions by controlled volumetric feeding equipment onto the apex of a cone, where the first blending step takes place and from which they fall in a cylindrical curtain to a lower plate where curved mixing blades complete the blending operation. If liquids are to be incorporated, they are sprayed onto the falling curtain from both sides. *The Johnson-March Corp., 1724 Chestnut St., Philadelphia 3, Pa.*

Vertical running panel saw

A conversion unit for all Hendrick panel saws Models MLR-P and C makes it possible to mount these saws vertically instead of horizontally. Floor-space saving and convenience in handling plastics sheet stocks are the main advantages of the vertical mounting. The panel saw is mounted on a length of 8-in. structural steel channel, supported by an angle-iron frame that tilts back 10° from the vertical. The cutting board is ¾-in. plywood and the stock to be cut rests on a trough at the bottom, 16 in. from floor level. Headroom required is 12 in. more than present saw length. Weight of saw and motor are offset by counter-weight attached by cables and sheaves, all provided. *Hendrick Mfg. Corp., 11 Selman St., Marblehead, Mass.*



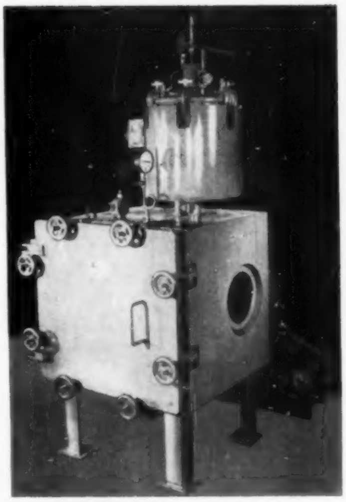
HENDRICK conversion unit makes possible vertical mounting of Models MLR-P and C saws. Floor-space saving and convenience are its main advantages.

Tensile tester

For use where bench space is at a premium in test locations, a new tensile testing unit can be mounted on the wall. The only bench space required is for the pump with its integral reservoir base. Tests can be made with sufficient accuracy for laboratory requirements, yet are simple enough to permit production use. Test specimens are gripped by hardened and ground jaws that are wedge type to insure positive grip. Breaking or yield point is indicated by a maximum-pointer hand that is carried along by the pressure hand on the gage. Models are available with capacities up to 40,000 pounds. *Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, Mich.*

Encapsulation equipment

High quality encapsulation and potting of electrical components in thermosetting resins on a batch production basis is possible with new vacuum type units available in a range of sizes. The system involves heating and vacuum degassing of the resin batch before pouring, simultaneous heating and drying of the parts to be potted, and control of pour. Units are available in five different series having working capacities from 1.3 to 390 cu. feet. Model 5A 1-P, shown in photo, is offered as a packaged unit complete with resin tank, potting chamber, vacuum pump with motor, and all necessary gages, valves, and piping, ready to set up and operate for $3260. Planetary type turntable to hold parts during resin pour available as an accessory at $425. *Hull-Standard Corp., Hatboro, Pa.*



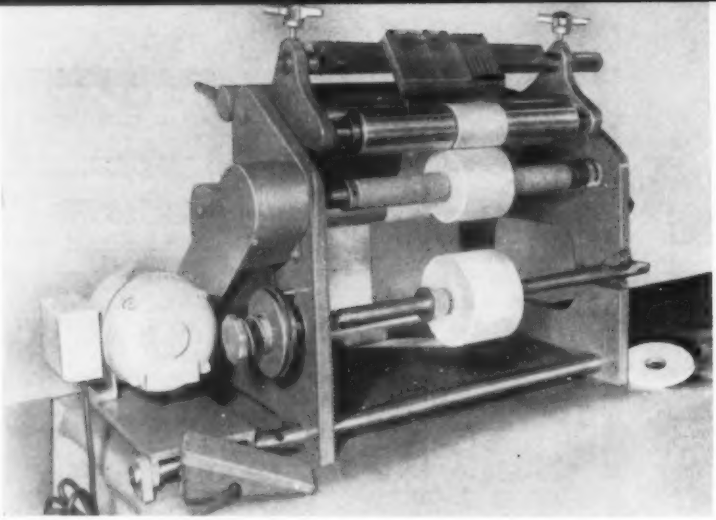
HULL-STANDARD potting unit Model 5A, complete with vacuum pump and motor, resin tank, etc.

Foot-operated marker

For use on plastics, metal, wood, and almost any other material, a new foot-powered marker will print at production-line speeds on flat, round, cylindrical, and irregular shaped surfaces. The complete unit is designed to be mounted on the edge of a table or bench. It consists of a printing bed with ink pad, an adjustable fixture bed for holding parts to be marked, actuating cables, and a foot pedal. Printing area is 2½ by 5½ inches. Printing can be done with rubber or brass type or dies. *Anderson-Stanley Stamp Co., 4101 W. Grand Ave., Chicago 51, Ill.*

Bench slitter

Intended primarily for slitting small parent rolls on short-run operations with a minimum of setup time, the BSR-18 bench-model unit is capable of slitting extremely thin materials into narrow widths. Thicknesses from 0.00025 to 0.040 in. can be handled with width as low as ⅛ in. and tolerance of 0.005 inch. Rewinding is done on single shaft. (*To page 134*)



APPLETON MACHINE Model BSR-18 bench slitter handles thicknesses from 0.00025 to 0.040 in. in widths as low as 1/8 inch.

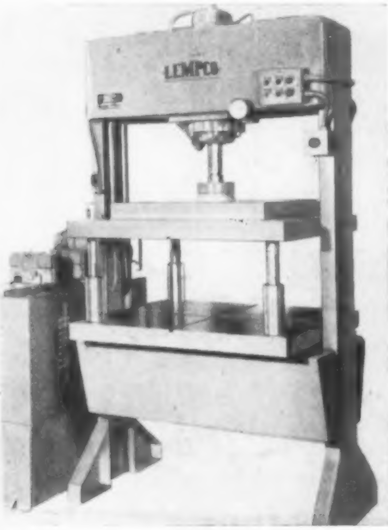
Model BSR-18 is operated by a 1/2 hp., three-speed 110-v. motor. Slitting speeds range from 45 to 700 ft./min. *Appleton Machine Co., Doven Div., Appleton, Wis.*

Hydraulic presses

The 628 and 628A series of presses are four-column, hydraulic, down-acting presses that feature ball-bearing bushings in their columns. These greatly reduce the columnar friction found in most column-type presses, also gives long press life with high accuracy. The series 628 presses are designed especially for plastics molding; the 628A are intended also for some metal-working operations—blanking, piercing, and die tryout. There are 10 models in each series, ranging in capacity from 25 to 150 tons, with 5- to 10-hp. motors, depending on ram speeds desired. Platen sizes are available in many combinations from 18 by 18 in. to 48 by 42 in., with special platen dimensions available on special order. The presses are available with all the usual options—timers, semi-automatic controls, variable approach and retraction speeds, pressure reversal, etc.

The 700 series presses by the same maker are also four-column jobs, but with bronze bushings. They are generally larger, ranging in tonnage from 25 to 600, in horsepower from 5 to 25, and in platen area from 18 by 12 to 72 by 60 inches. Standard equipment includes minimum for simple operations; there are many options. *Lempco Industrial, Inc., Machine & Tool Div., Bedford, Ohio.*

LEMPCO Model 628 hydraulic presses are especially designed for plastics molding.



Carbide lapping compound

Specifically prepared for lapping carbide dies and tools and polishing molds for plastics, a ready-to-use compound of oils and boron carbide is being marketed under the name of Tetrabor Paste. Closely resembling expensive diamond compounds in hardness and specific weight, Tetrabor Paste has a pressure resistance equivalent to diamond. When used in place of more conventional lapping compounds, it gives faster cutting action and superior finish. Kits containing 5 g. samples of 12 different grits—from 100 to 1200—are available at $15.50. *Titan Tool Supply Co., 1419 Hertel Ave., Buffalo 16, N. Y.*

Embossing roll stand

A heavy-duty embossing roll stand can deliver an embossing force up to 15 tons, controllable hydraulically. Rolls can be removed quickly, web height is easily changed by micrometer adjustment. Intended primarily for use with existing drives, the stand can be supplied with a variable speed drive. The standard model handles web widths up to 60 in., but special machines for wider webs are available. Maker will furnish preheating unit for web if it is needed. Other extras are: back-up rolls, idler rolls, water cooling of rolls, etc. Stand is ruggedly built with heavy cast iron frames, extra-heavy tie rods, heavy-duty bearings. This stand has been designed to provide the user with wide adaptability to his embossing needs. *Development Engineering Co., Inc., 9 Cross St., Norwalk, Conn.*

Adjustable speed drive

Precise operating speeds for process machinery, windups, conveyors, etc., are possible with a new Ajusto-Spede drive available in ratings from 3/4 to 7 1/2 hp. Because of its stationary field construction, all brushes, commutators, and slip-rings have been eliminated, substantially reducing maintenance. The drive shaft, height, and diameter dimensions are the same as a standard motor of comparable rating. In the Ajusto-Spede drive, an a.-c. motor drives a clutch drum at constant speed while speed of the clutch spider (output member) is adjusted by varying d.-c. excitation to the clutch coil. The drive is suitable for continuous operation at full load (constant torque) in ranges as high as 34:1 and for intermittent use at any speed up to full. Ajusto-Spede is also intended as an economical method of modernizing existing machinery. *The Louis Allis Co., 427 E. Stewart St., Milwaukee 1, Wis.*

Silk-screen printer

A new, low cost, production-line marker that prints trademarks, designs, patent numbers, part numbers, instructions, or other markings on plastics, leather, rubber, fiberboard, etc., prints by the silk-screen process and runs at a speed of 5000 cycles per hour. Intermittent operation permits worker to set his own pace, marking from 1 to 5000 pieces per hour. The printing mechanism of the new marker is housed entirely below the table surface to provide a completely unobstructed working area for the operator. Registering table, which is an integral part of the marker, has accurate registering guides and is slotted for attachment of jigs or fixtures. The unit has a completely enclosed ink fountain which prevents ink supply from drying, leaving unit always ready to print without washup. Quick change screens permit rapid switching of designs. *General Research & Supply Co., 572 S. Division Ave., Grand Rapids, Mich.*—END

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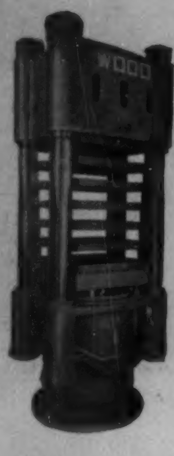

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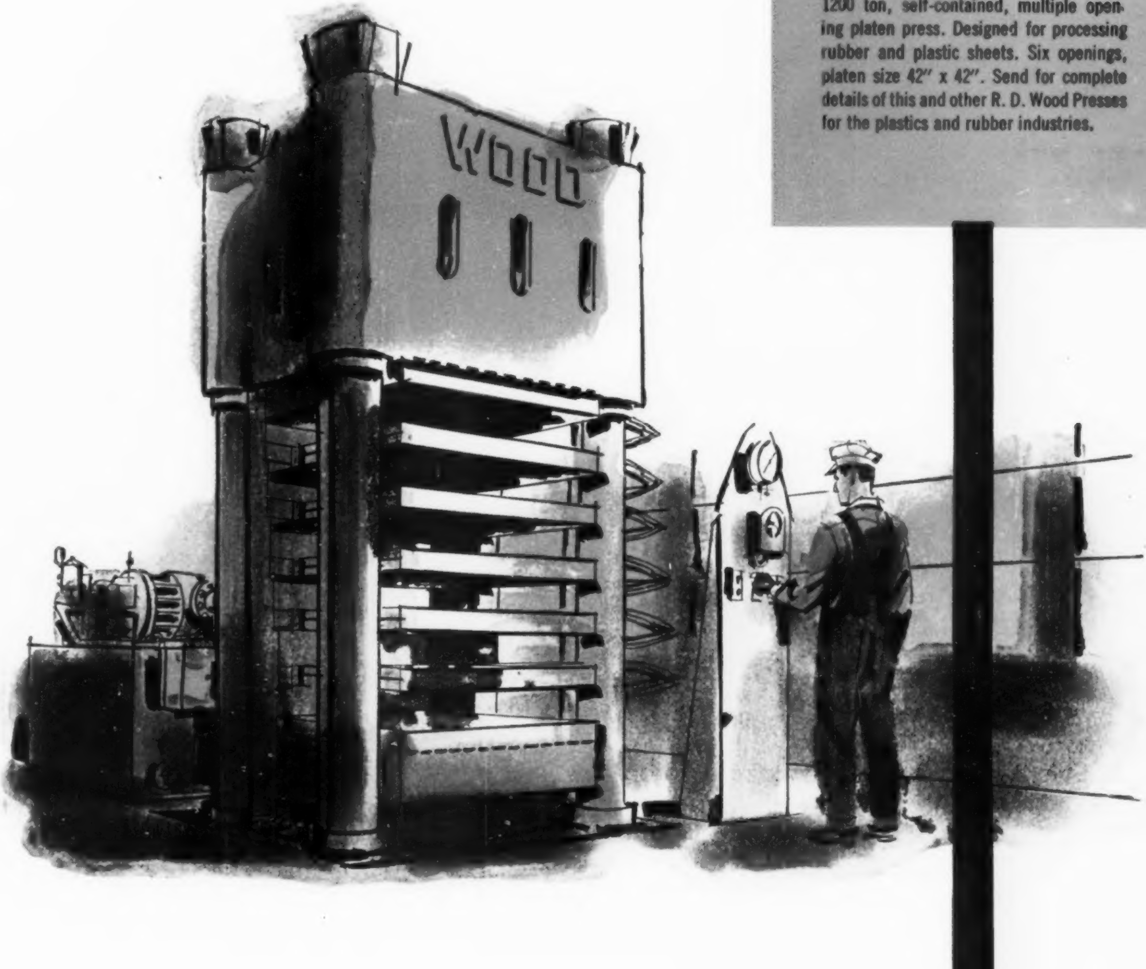

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Effect of low-m.w. polyethylene waxes on PE injection moldings

By K. A. Kaufmann† and C. S. Imig‡

An investigation was undertaken to determine the practical advantages and disadvantages of adding polyethylene waxes to polyethylene resins from the viewpoint of an injection molder in a very competitive market. In general, the advantages are: 1) on the basis of equivalent melt index comparisons, a possible slight improvement in flowability; 2) improved colorability at the higher melt index levels; and 3) the possibility of slightly improved stiffness. Among the disadvantages are: 1) poorer low temperature resistance; 2) a general degradation of most other physical properties; and 3) the difficulty of obtaining a satisfactory blended homogeneity of the wax and the polyethylene in normal dry blending operations. The latter point is of major consideration because localized agglomerated particles of wax are focal points of weakness for stress cracking, low temperature brittleness, and mechanical weakness.

A claim that has been made in favor of this blending is that the molder may tailor-make the proper melt index for a given molding job. This is indeed true, and if the advantages outweigh the disadvantages, and if a homogeneous blend can be achieved, there is no reason why the molder cannot follow this practice.

For some time now, injection molders of polyethylene housewares and other items have been blending small proportions of low-molecular-weight polyethylene waxes with standard virgin polyethylene resins. This procedure has been followed for a variety of reasons, the main one being improved flow properties. Other claims made to support this practice include improved environmental stress crack properties, improved gloss, improved low temperature brittleness, faster cycles, and improved color dispersions. This investigation was undertaken to resolve these claims, particularly on compounds of equivalent melt index.

The wax used in this work is a commercially available low-molecular-weight polyethylene wax supplied in large pellet form. It has a molecular weight around 6000, or about one-fourth that of most standard virgin polyethylene products available to the molding industry.

Samples of Spencer Poly-Eth 1003, 1005, 1007, 1405, and 1407 resins were dry blended with 0.25% Watchung Red pigment and various amounts of wax. These samples were then mixed thoroughly on a hot roll mill along with control samples of 1003, 1005, 1007, 1008.5, 1405, 1407, and 1408.5 without any wax. All samples were compression molded into slabs for physical testing. Nominal melt indexes and densities of these standard Spencer resins are shown in Table I, below.

The results of the physical tests are shown in Table II, p. 138. It may be seen that the addition of wax to the 1000 series resins generally decreased tensile strength, resistance to low temperature brittleness, and resistance to environmental stress-cracking. The density, yield point, and elongation remained substantially the same, while the stiffness was only slightly, if any, improved. The Vicat softening point varied erratically with the addition of the wax and as had been predicted, the melt index increased considerably.

In comparing the materials of approximately the same melt index, we find that the density, yield point, elongation, Vicat softening point, and resistance to

Table I: Identification of Poly-Eth resins

Poly-Eth number	Nominal melt index[a]	Nominal density[b]
	g./10 min.	g./cc.
1003	0.5	0.917
1005	2.0	0.917
1007	8.0	0.917
1008.5	23.0	0.917
1405	2.0	0.925
1407	8.0	0.925
1408.5	23.0	0.925

[a] ASTM D 1238-54T
[b] ASTM D 792-50

* Reg. U. S. Pat. Off.
† Formerly manager, Plastics Technical Service, Spencer Chemical Co.; present address, Amoco Chemicals Corp., Chicago, Ill.
‡ Senior staff member, Plastics Technical Service, Spencer Chemical Co., Kansas City, Mo.

Table II: Effect on physical properties of addition of polyethylene wax to Poly-Eth resins

Amount of wax	*Melt index (D 1238-54T)*	*Density (D 792-50)*	*Stress-strain properties (D 412-51T)* Tensile strength	Yield	Elongation	*Stiffness (D 747-50)*	*Vicat soft. point (D 1525-58T)*	*Low temp. brittleness (D 746-55T), failure at* −70°C	−100°C	*Environmental stress crack (bent strip)* F_{50}	F_{100}
%	g./10 min.	g./cc.	p.s.i.	p.s.i.	%	p.s.i.	°C.	%	%		
					Poly-Eth 1003						
0	0.5	0.918	2000	1000	550	19,000	92	5	0	>336 hr.	—
9	1.4	0.920	1700	1000	550	26,000	89	0	0	>336 hr.	—
14	2.3	0.920	1700	950	550	27,000	89	0	80	>336 hr.	—
					Poly-Eth 1005						
0	1.9	0.917	1850	900	550	12,000	84	0	10	>336 hr.	—
9	4.0	0.919	1700	900	550	20,000	87	10	70	30 min.	50 min.
17	7.5	0.919	1250	850	550	22,000	85	0	100	< 5 min.	10 min.
					Poly-Eth 1007						
0	9.3	0.919	1300	850	500	19,000	88	0	100	< 5 min.	10 min.
9	12.2	0.917	1150	800	500	16,000	82	35	100	< 5 min.	10 min.
14	17.7	0.916	1050	850	500	18,000	80	100	—	—	5 min.
					Poly-Eth 1008.5						
0	25.5	0.916	1200	850	450	17,000	80	90	100	< 5 min.	10 min.
					Poly-Eth 1405						
0	2.2	0.929	1700	1500	500	28,000	100	0	0	30 min.	60 min.
9	4.0	0.927	1650	1400	150	33,000	103	5	0	>5 min.	10 min.
17	6.5	0.926	1500	1350	100	30,000	96	35	100	>5 min.	10 min.
					Poly-Eth 1407						
0	8.8	0.927	1750	1550	250	33,000	92	51	20	—	5 min.
9	15.8	0.927	1600	1400	100	28,000	95	45	100	—	5 min.
14	21.9	0.926	1550	1400	100	32,000	90	100	—	—	5 min.
					Poly-Eth 1408.5						
0	23.3	0.926	1550	1400	100	32,000	91	100	—	—	5 min.

environmental stress-cracking remained about the same, again with the stiffness only slightly, if any, improved. Both the tensile strength and resistance to low temperature brittleness decreased.

The addition of wax to the 1400 series resins did not seem to affect the density and stiffness. The probable reason for this is that the wax had a density similar to that of the standard polyethylene used, and thus a close similarity in stiffness, since density is the major function on which stiffness depends. Again, the variation of the Vicat softening point with the amount of wax was quite erratic, so no conclusions could be drawn. The tensile strength, yield point, elongation, resistance to low temperature brittleness, and resistance to environmental stress-cracking decreased. Of course, the melt index again increased. If we also compare materials of similar melt index in this case, we find that the density, stiffness, Vicat softening point, and resistance to environmental stress-cracking were substantially unchanged. The tensile strength, yield point, and elongation were about the same or slightly reduced, while the resistance to low temperature brittleness was decreased.

Samples of 1003, 1005, 1007, 1008.5, 1405, 1407 and 1408.5 resins were dry blended with 0.25% Watchung Red pigment either with or without various amounts of wax. These materials were then injection molded into wastebaskets on a 20-oz. HPM molding machine at cylinder temperatures of 500 and 600° F. In the case of 1003 without wax, a temperature of 650° F. was required to fill the mold. The minimum cycle time was then determined, and the resulting parts examined for surface gloss, color dispersion, wax dispersion, and warpage. It should be noted that the operating pressures used are not related directly to the minimum pressure required to fill the mold and are, therefore, only an indication of the ease of flow of the given material. The surface appearance, color, and wax dispersion were rated in numbers from 1 through 10 with the lower number being the best. The warpage was rated in numbers from 1 through 4, again with the lower number the best. It should be noted that the wax did not always disperse well, particularly when used at higher concentrations in lower melt index resins.

Results obtained on molding

these materials are summarized in Table III, below. It may be seen that the addition of wax to the 1000 series resins improved the ease of flow and surface gloss. The cycle time and color dispersion were about the same or slightly decreased, while the warpage remained the same and the wax dispersion decreased. Comparing like melt indexes, the ease of flow again seemed to improve, while the surface gloss, cycle time, and color dispersion remained the same or decreased

Table III: Effect on molding characteristics of addition of polyethylene wax to Poly-Eth resins

Amount of wax	Temperature			Injection pressure	Cycle			Shot wt.	Surface gloss[a]	Dispersion		Warpage[a]
	Cylinder	Stock	Mold		Total clamp	Plunger forward	Booster			Color[a]	Wax	
%	°F.	°F.	°F.	p.s.i.	sec.	sec.	sec.	g.				
						Poly-Eth 1003						
0	600	—	60	Max.		Would not fill		—	—	—	—	—
0	650	—	60	2100	90	15	9	401	8	2	—	3
9	500	—	60	Max.		Would not fill		—	—	—	—	—
9	600	—	60	1800	60	10	6	407	10[b]	6	6	4
14	500	440	60	2000	55	10	6	374	10[b]	10	10	3
14	600	—	60	1400	60	10	6	—	9[b]	8	8	4
						Poly-Eth 1005						
0	500	—	60	—		Would not fill		—	—	—	—	—
0	600	570	60	1850	60	10	8	402	8	1	—	3
9	500	460	60	1800	60	10	5	388	10[b]	3	4	2
9	600	550	60	1200	55	9	5	385	7	2	2	2
17	500	460	60	1600	46	7	4	389	9[b]	6	9	2
17	600	560	60	1050	55	12	5	385	9[b]	6	7	3
						Poly-Eth 1007						
0	500	460	60	1800	55	15	6	389	6	2	—	2
0	600	—	60	1200	55	12	5	386	2	3	—	2
9	500	—	60	1400	55	10	5	386	5	2	2	2
9	600	500	60	1000	55	8	4	386	1	2	2	2
14	500	465	60	1100	55	15	5	389	1[b]	1	1	2
14	600	—	60	1100	55	10	6	389	1	2	2	2
						Poly-Eth 1008.5						
0	500	—	60	1500	55	15	3	—	1	4	—	1
0	600	550	60	1100	55	9	5	391	1	5	—	1
						Poly-Eth 1405						
0	500	—	60	—		Would not fill		—	—	—	—	—
0	600	550	60	1900	65	15	6	384	2	5	—	2
9	500	465	60	1800	60	10	6	392	6	2	4	3
9	600	560	60	1400	55	6	5	389	1	2	2	2
17	500	465	60	1300	35	7	4	390	7	6	7	3
17	600	560	60	1500	55	15	4	389	1[b]	3	3	3
						Poly-Eth 1407						
0	500	475	60	1500	45	15	6	391	1	5	—	2
0	600	560	60	1000	55	15	6	386	1	7	—	3
9	500	—	60	1200	45	15	6	391	1[b]	2	2	1
9	600	550	60	1150	50	20	6	390	1[b]	2	1	2
14	500	430	60	1400	50	10	6	389	1	5	5	1
14	600	560	60	900	55	25	4	393	1	2	2	1
						Poly-Eth 1408.5						
0	500	450	60	1100	45	15	6	386	1	7	—	2
0	600	550	60	1000	55	15	6	389	1	7	—	1

[a]The lower the number, the better the property
[b]Delamination

Table IV: Effect of wax addition on properties of injection moldings

Poly-Eth resin	Amt. of wax	500° F. molding temperature: Environmental stress-crack (bent strip) F_{50}		500° F.: Cold smash test, 100% failure	600° F. molding temperature: Environmental stress-crack (bent strip) F_{50}		600° F.: Cold smash test, 100% failure
		F_{50}	F_{100}		F_{50}	F_{100}	
	%	min.	min.	°F.	min.	min.	°F.
1003	0	—	—	—	20	40	−20
	9	—	—	—	10	30	0
	14	5	20	0	5	50	0
1005	0	—	—	—	10	30	−20
	9	<5	10	0	<5	10	0
	17	<5	10	0	<5	10	0
1007	0	—	5	−20	<5	10	−20
	9	—	5	0	—	5	0
	14	—	5	0	—	5	0
1008.5	0	—	5	−20	—	5	−20
1405	0	—	—	—	30	60	−20
	9	<5	10	0	<5	15	0
	17	—	5	0	<5	10	0
1407	0	<5	10	0	<5	10	0
	9	—	5	0	<5	10	0
	14	—	5	0	—	5	0
1408.5	0	—	5	0	—	5	0

somewhat. The warpage remained the same.

The addition of wax to the 1400 series resins improved the flow and surface gloss while decreasing the wax dispersion. The color dispersion was improved in the higher melt index range, but decreased in the lower melt index range. The cycle time seemed unaffected, while the warpage was either the same or somewhat decreased. Comparing like melt indexes, the ease of flow and color dispersion were better. The cycle time and warpage were about the same; surface gloss was the same or slightly improved.

Effect on properties of molding

Since the physical properties of the molded part are important, environmental stress-cracking and cold smash tests were run on the wastebaskets. The cold smash tests were carried out by conditioning the specimens at the desired temperature for 4 hr., then hitting them strongly with an 8-lb. sledge hammer.

Results of these tests are summarized in Table IV, above. Briefly, the resistance to impact at low temperatures decreased with the addition of wax, even when comparing materials of like melt index. The resistance to environmental stress-cracking decreased with the addition of the wax; but when comparing the compounds of like melt index, it was similar.

Conclusions

The effects of the addition of wax to Spencer Poly-Eth 1000 and 1400 series resins are summarized in Table V, below, together with a comparison of similar melt index materials with one being regular polyethylene, and the other a lower melt index material containing the wax. The advantages of the use of wax to the molder are slightly better flowability at comparable melt index levels, improved color dispersion in higher melt index levels, and the possibility of slightly increased stiffness. At the same time, he must expect decreased resistance to low temperature impact, possible degradation of most other physical properties, and difficulty in obtaining good dispersion of the wax. In conclusion, it seems that, except for improved color dispersion with higher melt index resins, there is little advantage to the use of wax by the molder. The primary disadvantages are difficulty in obtaining good dispersion of the wax and decreased resistance to low temperature impact.—END

Table V: Summary of effects of addition of polyethylene wax to polyethylene resins

Physical properties	*Effect on base material*	*Comparison of materials of similar melt index*
Melt index	Increased	—
Density	Same	Same
Tensile strength	Decreased	Same or decreased
Yield point	Same or decreased	Same or decreased
Elongation	Same or decreased	Same or decreased
Stiffness	Same or increased	Same or increased
Vicat softening point	Undefined	Same
Low temp. brittleness	Decreased	Decreased
Stress-crack resistance	Decreased	Same
Molding characteristics		
Ease of flow	Increased	Increased
Cycle time	Same or decreased	Same or decreased
Surface gloss	Increased	Same or decreased
Color dispersion	Decreased or increased[a]	Decreased or increased[a]
Wax dispersion	Decreased	—
Warpage	Same or decreased	Same
Properties of moldings		
Cold smash resistance	Decreased	Decreased
Stress-crack resistance	Decreased	Same

[a]Improvement generally in the higher melt index resins.

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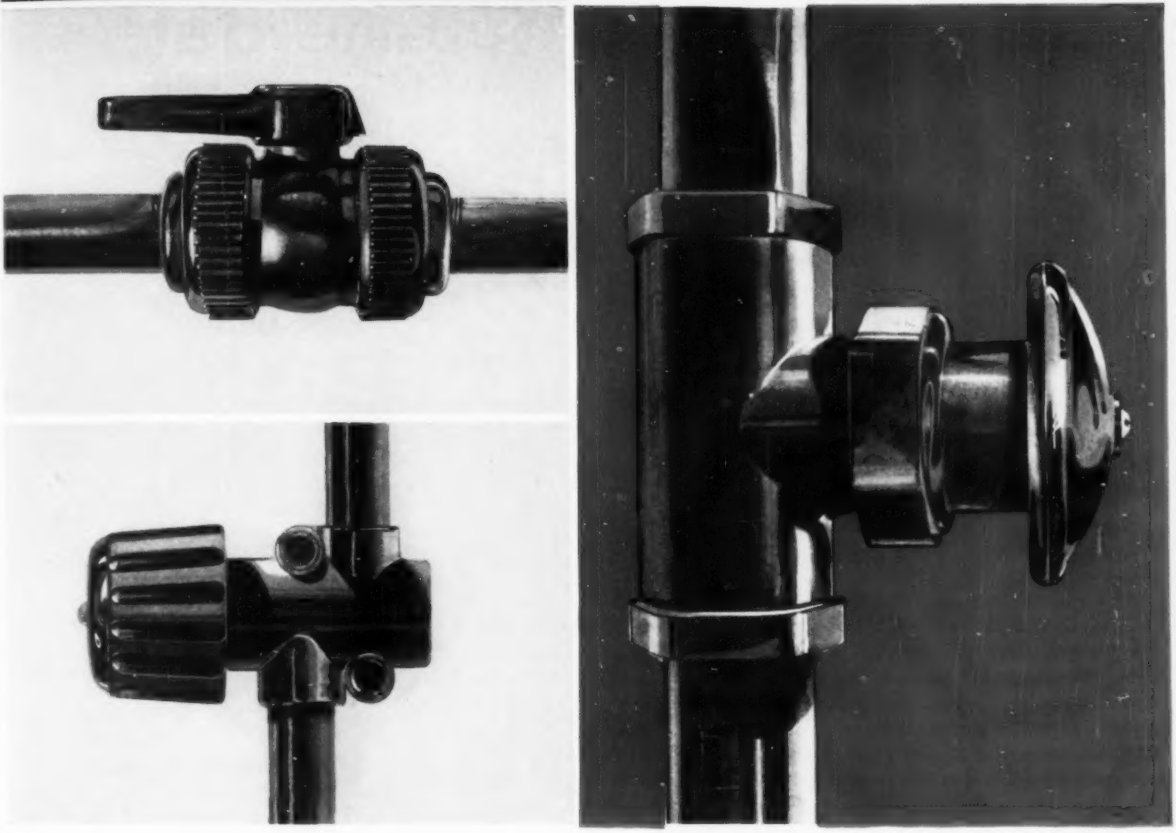

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Evaluation of organic peroxides from half-life data

Donald F. Doehnert* and Orville L. Mageli*

Half-life data for 20 organic peroxides were obtained from decomposition studies in dilute solutions and are summarized in graphical and tabular form. Each peroxide is evaluated by comparison with the other peroxides on the basis of half-life values and activation energies, thus establishing two scales of relative peroxide activity. The data presented give the basic information needed for the choice of an effective initiator for any free radical polymerization system.

A considerable number of organic peroxides are commercially available either in the pure form or compounded with suitable diluents. The choice of the most effective initiator in any particular polymerization system is a difficult one. The efficiency of a free-radical initiator depends primarily upon its thermal decomposition rate at a given temperature and upon the ability of the free radicals formed to carry out the desired reaction. A convenient means of expressing the rate of decomposition of an organic peroxide at a specified temperature is in terms of its half-life which is the time required for one-half of the peroxide originally present to decompose. As a first approach in finding the best peroxide initiator, one should select the peroxide with half-life characteristics best suited to the conditions of the polymerization reaction. Unfortunately, the available half-life data are scattered throughout the literature and in many instances are not comparable because of variations in solvents, concentrations, or temperatures used. The work reported in this paper is an effort to evaluate each peroxide in terms of a large number of other commercially available peroxides and peroxide compounds on the basis of its half-life in a common, relatively inert solvent and at a comparable concentration.

Organic peroxides may be regarded as derivatives of hydrogen peroxide, H-O-O-H, that were obtained by replacing one or both of the hydrogen atoms by organic radicals.

These compounds are of the general type R-O-O-R′ where R and R′ may be alkyl, acyl, or hydrogen. In a solvent or monomer the initial step in the thermal decomposition of organic peroxides probably involves the homolytic cleavage of the -O-O- bond to give the free radicals RO· and R′O·. The free radicals may form products of decomposition or react with monomer to initiate polymerization. In an organic solvent they react to form various decomposition products. In an unsaturated monomer the free radicals may add to the double bond to initiate polymerization and/or react to form various products of decomposition.

The variation of certain factors must be minimized in order to study thermal decomposition rates and establish a scale of organic peroxide reactivities. One of the variables is the type of solvent since the solvent can have a bearing on the nature and rate of decomposition of the peroxide. The non-polar hydrocarbon, benzene, was chosen as it is relatively inert to radical attack and also because it is a good solvent for most of the peroxides.

It is easily obtained in high purity and has been used previously in studies of decomposition rates of some peroxides. Only succinic acid peroxide is not sufficiently soluble in benzene. It was therefore studied in acetone.

Another factor that should be kept constant is the peroxide concentration in the solvent. It is advisable to use solutions as dilute as possible in order to minimize induced decomposition. Concen-

(To page 144)

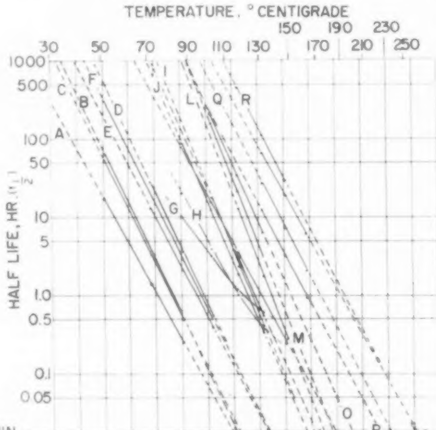

FIG. 1: Half-life—temperature curves for various organic peroxides in dilute benzene solutions. Curve A—2, 4-dichlorobenzoyl peroxide; B—caprylyl peroxide; C—lauroyl peroxide; D—t-butyl peroxyisobutyrate; E—benzoyl peroxide; F—p-chlorobenzoyl peroxide; G—Hydroxyheptyl peroxide; H—cyclohexanone peroxide; I—di-t-butyl-diperphthalate; J—t-butyl peracetate; K—t-butyl perbenzoate; L—dicumyl peroxide; M—t-butyl hydroperoxide; N—methyl ethyl ketone peroxide; O—di-t butyl peroxide; P—p-menthane hydroperoxide; Q—pinane hydroperoxide; R—cumene hydroperoxide; S—2, 5-dimethylhexane-2, 5-dihydroperoxide.

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trations of peroxide were used that approximate those used in commercial polymerization reactions.

The third variable is the actual decomposition procedure used. The experimental procedure was kept as constant as possible. Each peroxide decomposition was carried out under a nitrogen atmosphere in a series (18 to 22) of sealed glass tubes. The sealed tubes were heated by immersion in a constant temperature bath.

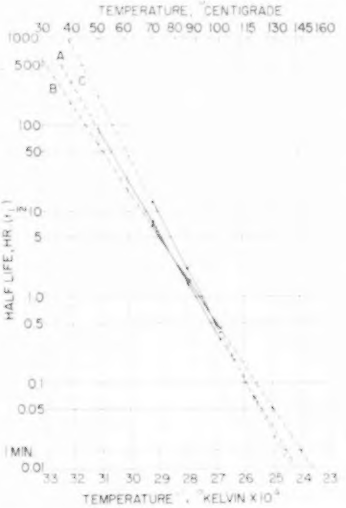


FIG. 2: Half-life—temperature curves for succinic acid peroxide and benzoyl peroxide in dilute acetone solutions, with a comparable curve for benzoyl peroxide in benzene. Curve A—benzoyl peroxide; B—succinic acid peroxide; C—benzoyl peroxide in benzene.

Individual tubes were withdrawn from the bath at periodic intervals and peroxide determinations were then made.

The major variable, which could be easily adjusted to cover a fairly wide range, was temperature. Temperatures had to be varied between 50 and 160° C. so that the decomposition rates could be measured over practical time intervals. Intervals of several hundred hours were impractical and intervals of a few minutes tended to lead to errors in measurement.

Thus, by varying only the temperature and standardizing other factors such as solvent, peroxide concentration, and experimental procedure, it was possible to establish an order of organic reactivity based on half-life.

Materials and methods

For this investigation only those organic peroxides were used that are now commercially available in the pure state or as peroxide compounds. The solvents used in the investigation (benzene and acetone) were peroxide-free reagent grade materials.

The proper amount of peroxide was weighed and dissolved in the solvent. The solution was filtered and 10-ml. samples were pipetted into 19- by 150-mm. clean test tubes. The filled tubes, which had about 5 ml. of air space remaining, were flushed with dry nitrogen, sealed, immersed in a silicone oil bath, and heated for specified periods of time. The oil bath was continuously stirred and a constant temperature was maintained within ±0.1° C. The tubes were withdrawn from the oil bath periodically and cooled rapidly by immersion in ice water. The contents were analyzed for undecomposed peroxide by treatment of the organic peroxide solution with an iodide and titration of the liberated iodine with sodium thiosulfate.

The specific procedures that were used for each peroxide varied in the choice of solvent, iodide, and reaction conditions required to give complete reduction. The equations are:

$$R{-}O{-}O{-}R + 2\,HI \rightarrow ROH + I_2$$

$$I_2 + 2\,Na_2S_2O_3 \rightarrow 2\,NaI + Na_2S_4O_6$$

Kinetic calculations

The thermal decomposition of peroxides in inert solvents has been shown to follow first order kinetics. The first order rate constant (k) was determined from the slope of the line obtained by plotting the logarithm of residual peroxide concentration (in moles of peroxide group per liter of solution) versus time. Each line was obtained by plotting from 8 to 11 points (each point an average of two values) and k was calculated from two points on what was judged to be the best straight line that could be drawn for each set of data. The half-life ($t_{1/2}$) in hours was then calculated from the equation $t_{1/2} = 0.693/k$, where k is the first order rate constant. For the few peroxides that did not decompose according to first order law, the half-life values were obtained directly from the plot of residual peroxide concentration versus time. After obtaining half-life values for each peroxide at a series of temperatures, the logarithm of the half-life versus the reciprocal of the absolute temperature (1/T) was plotted and, in most cases, a straight line relationship was obtained. The activation energy associated with the breaking of the peroxide bond and the generation of free radicals for first order decompositions was calculated from the slope of this line. These data have been summarized in the accompanying tables and figures.

Results

Tables I, p. 146, and III, p. 148, list the organic peroxides and peroxide compounds with their formulae, typical assays, and concentrations used. For each peroxide half-life data are given for selected temperatures together with first order rate constants and the calculated activation energy value. Tables II, p. 147, and IV, p. 148, list the organic peroxides in order of the increasing temperatures at which their half-life values are 1 min., 10 hr., and 100 hours. Figures 1, p. 142, and 2, left, give half-life—temperature curves for the organic peroxides in dilute solutions in benzene and acetone, respectively.

Each peroxide can be evaluated in terms of a large number of other peroxides and peroxide compounds on the basis of half-life in the solvent benzene. Although the actual experimental determinations of half-life were carried out over a limited range of temperatures, the straight line curves have been extrapolated (dotted lines, Fig. 1) to cover values above and below this range. Thus, it is possible to estimate peroxide half-life at temperatures where (*To page 147*)

Table I: Decomposition of peroxide and peroxide compounds in benzene

Curve (Fig. 1)	Peroxide	Assay: Peroxide	Assay: Active oxygen	Conc. of peroxide group (-O-O-)	Temp.	Half-life ($t_{1/2}$)	First order rate constant (k)	Activation energy (△E)
		%	%	moles/l.	°C.	hr.	$hr.^{-1}$	kcal./mole
A	2,4-Dichlorobenzoyl peroxide with dibutyl phthalate	51.1	2.15	0.1	50	17.8	0.039	28.1
					70	1.41	0.492	
					85	0.25	2.77	
B	Caprylyl peroxide in mineral oil	50.1	5.2	0.2	50	64.5	0.0108	31.8
					70	3.7	0.187	
					85	0.5	1.39	
C	Lauroyl peroxide	98.0	3.94	0.2	50	54.2	0.0128	30.7
					70	3.38	0.205	
					85	0.5	1.39	
D	t-Butyl peroxyisobutyrate in benzene	75.0	7.5	0.2	70	28.8	0.0241	33.5
					85	3.51	0.192	
					100	0.55	1.26	
E	Benzoyl peroxide	98.2	6.5	0.2	70	13.0	0.0534	30.0
					85	2.15	0.322	
					100	0.40	1.75	
F	p-Chlorobenzoyl peroxide with dibutyl phthalate	50.9	2.55	0.1	50	310.0	0.00224	30.6
					85	2.9	.239	
					100	0.5	1.39	
G	Hydroxyheptyl peroxide	98.0	6.0	0.2	85	10.0		
					100	3.22		
					115	1.19		
					130	0.58		
H	Cyclohexanone peroxide with dibutyl phthalate	85.0	11.0	0.2	85	20.0		
					100	3.85		
					115	1.01		
					130	0.37		
I	Di-t-butyl diperphthalate in dibutyl phthalate	50.8	5.18	0.2	100	17.8	0.039	37.7
					115	2.47	0.281	
					130	0.4	1.73	
J	t-Butyl peracetate in benzene	75.0	9.1	0.2	85	88.0	0.00788	35.9
					100	12.5	0.0554	
					115	1.88	0.369	
					130	0.34	2.05	
K	t-Butyl perbenzoate	98.0	8.07	0.2	100	18.0	0.0385	34.7
					115	3.1	0.224	
					130	0.55	1.26	
L	Dicumyl peroxide	96.5	5.7	0.2	115	12.4	0.056	40.6
					130	1.84	0.377	
					145	0.28	2.47	
M	t-Butyl hydroperoxide (Com. product containing approx. 20% di-t-butyl peroxide.)	72.1	12.7	0.2	100	165.0		
					115	21.5		
					130	3.2		
N	Methyl ethyl ketone peroxide in dimethyl phthalate		11.0	0.2	85	81.2	0.00854	28.5
					100	16.2	0.0428	
					115	3.6	0.193	
					145	0.25	2.77	
O	Di-t-butyl peroxide	98.5	10.8	0.2	100	218.0	0.00318	35.1
					115	34.0	0.0204	
					130	6.4	0.108	
P	p-Menthane hydroperoxide	54.7	5.09	0.2	130	12.5	0.0554	33.4
					145	3.2	0.217	
					160	0.93	0.745	
Q	Pinane hydroperoxide	75.0	7.06	0.2	130	27.2	0.0255	29.6
					145	7.0	0.098	
					160	2.1	0.33	
R	Cumene hydroperoxide	88.2	9.3	0.2	115	472.0	0.00146	30.0
					130	113.0	0.00614	
					145	29.0	0.0239	
S	2,5-Dimethylhexane-2,5-dihydroperoxide	98.2	17.5	0.1	130	67.0		
					145	18.8		
					160	6.1		

it was impractical to make experimental determinations. In order to obtain the half-life for a peroxide at any specified temperature, the following procedures may be used.

Example 1. Half-life of benzoyl peroxide at 85° C.: Using Fig. 1 and reading the curve E for 85° C. a half-life value of 2.15 hr. is found.

Example 2. Half-life of benzoyl peroxide at 110° C.: An approximate value may be obtained by using the procedure described under Example 1. A more accurate value may be obtained by first converting the temperature in degrees Centigrade to degrees Kelvin (110° C. equals 383.16° K.) using the lower abscissa and again reading the half-life from curve *E*. The value for 1/T is read on the lower abscissa as 26.1×10^{-4}, which on curve *E* gives a half-life of 0.15 hours.

Comparison of peroxide activities

For further assistance in the choice of an initiator, the organic peroxides have been compared on the basis of constant half-life values (Table II). When two peroxides have the same half-life, they must, therefore, be decomposing at the same rate. The temperatures corresponding to this rate may be widely different. Three constant half-life values (1 min., 10 hr., and 100 hr.) were chosen and the peroxides were listed in order of increasing temperatures corresponding to each specific half-life value. The order of peroxides varies, somewhat, between the three half-life values chosen, but the table is still a useful guide for the choice of a peroxide initiator to meet practical requirements for half-life and operating temperatures.

From the data of Table II, it can be seen that 2,4-dichlorobenzoyl peroxide is the most active peroxide and would be expected to initiate reactions at the lowest temperature, while cumene hydroperoxide and 2,5-dimethylhexane-2,5-dihydroperoxide would require the highest temperatures to perform effectively as initiators. There are no large gaps in the temperature range based on constant half-lives for these peroxides and this gradual change in activity offers a wide selection to the user. It should be noted at this point that this order of peroxides is obtained under ideal conditions in the absence of any activators or inhibitors. The addition of any activator or inhibitor will change the order since it will affect various peroxide structures differently.

Most of the peroxides tested decomposed according to first order kinetics. The peroxides that did not approximate first order decomposition were hydroxyheptyl peroxide, cyclohexanone peroxide, commercial *t*-butyl hydroperoxide and 2,5-dimethylhexane-2,5-dihydroperoxide. First order rate constants and activation energies are not reported for these four products. Hydroxyheptyl peroxide and cyclohexanone peroxide did not give linear curves when the logarithms of the half-life values were plotted against the reciprocal of the absolute temperature. This fact might be explained on the basis that other peroxide structures could be formed during the decomposition since it is well-known that ketone and aldehyde peroxides can dissociate in solution. Straight line curves were obtained from the half-life data for commercial *t*-butyl hydroperoxide and for 2,5-dimethylhexane-2,5-dihydroperoxide. These results were unexpected and are the subject of further studies.

One peroxide (succinic acid peroxide) was not sufficiently soluble in benzene and therefore the decomposition was studied in

Table II: Decomposition temperatures of organic peroxides in benzene at selected half- life values

Peroxide	*Temp. for $t_{1/2} = 1$ min*	*Peroxide*	*Temp. for $t_{1/2} = 10$ hr.*	*Peroxide*	*Temp. for $t_{1/2} = 100$ hr.*
	°C.		°C.		°C.
2,4-Dichlorobenzoyl peroxide	112	2,4-Dichlorobenzoyl peroxide	54	2,4-Dichlorobenzoyl peroxide	37
Caprylyl peroxide	114	Lauroyl peroxide	62	Lauroyl peroxide	46
Lauroyl peroxide	115	Caprylyl peroxide	63	Caprylyl peroxide	47
t-Butyl peroxyisobutyrate	131	Benzoyl peroxide	72	Benzoyl peroxide	54
Benzoyl peroxide	133	*p*-Chlorobenzoyl peroxide	75	*p*-Chlorobenzoyl peroxide	58
p-Chlorobenzoyl peroxide	133	*t*-Butyl peroxyisobutyrate	79	Hydroxyheptyl peroxide	58
Di-*t*-butyl diperphthalate	159	Hydroxyheptyl peroxide	85	*t*-Butyl peroxyisobutyrate	62
t-Butyl peracetate	159	Cyclohexanone peroxide	91	Cyclohexanone peroxide	71
t-Butyl perbenzoate	166	*t*-Butyl peracetate	102	Methyl ethyl ketone peroxide	83
Dicumyl peroxide	171	Di-*t*-butyl diperphthalate	105	*t*-Butyl peracetate	84
t-Butyl hydroperoxide[a]	179	*t*-Butyl perbenzoate	105	*t*-Butyl perbenzoate	87
Methyl ethyl ketone peroxide	182	Methyl ethyl ketone peroxide	105	Di-*t*-butyl diperphthalate	88
Di-*t*-butyl peroxide	193	Dicumyl peroxide	117	Dicumyl peroxide	101
p-Menthane hydroperoxide	216	*t*-Butyl hydroperoxide (C)[a]	121	*t*-Butyl hydroperoxide (C)[a]	104
Pinane hydroperoxide	229	Di-*t*-butyl peroxide	126	Di-*t*-butyl peroxide	106
Cumene hydroperoxide	255	*p*-Menthane hydroperoxide	133	*p*-Menthane hydroperoxide	109
2,5-Dimethylhexane-2,5-dihydroperoxide	257	Pinane hydroperoxide	141	Pinane hydroperoxide	117
		2,5-Dimethylhexane-2,5-dihydroperoxide	154	2,5-Dimethylhexane-2,5-dihydroperoxide	126
		Cumene hydroperoxide	158	Cumene hydroperoxide	132

[a] (Commercial *t*-butyl hydroperoxide contains about 20% di-*t*-butyl peroxide).

Table III: Decomposition of succinic acid peroxide and benzoyl peroxide in acetone

Curve (Fig. 2)	*Peroxide*	*Assay* *Peroxide*	*Assay* *Active oxygen*	*Conc. of peroxide group (-O-O-)*	*Temp.*	*Half-life ($t_{1/2}$)*	*First order rate constant (k)*	*Activation energy ($\triangle E$)*
		%	%	*moles/l.*	°C.	*hr.*	$hr.^{-1}$	*kcal./mole*
A	Benzoyl peroxide[a]	98.2	6.5	0.1	50	85.6	0.0081	26.8
					70	7.32	0.0947	
					85	1.44	0.482	
					100	0.33	2.1	
B	Succinic acid peroxide	95.4	6.52	0.1	70	6.86	0.101	23.8
					85	1.59	0.436	
					100	0.44	1.57	

[a] See Table I for decomposition data on benzoyl peroxide in benzene.

acetone. In order to get data which would be comparable with the results in benzene, benzoyl peroxide was also studied in acetone under similar conditions. Although the decomposition rate for benzoyl peroxide in acetone was somewhat greater than the rate in benzene at temperatures below 115° C., the results were similar and succinic acid peroxide can be evaluated in terms of the other organic peroxides through its relationship to benzoyl peroxide (Table IV).

Activation energies (ΔE) have been calculated for all those peroxides that showed first order decomposition. The activation energy may be determined from measurements of the specific rate constant (k) at two or more temperatures according to the following equation:

$$\log \frac{k_2}{k_1} = \frac{\Delta E}{2.303\ R}\left(\frac{T_2 - T_1}{T_2\ T_1}\right)$$

where R = universal gas constant (1.987 cal. deg.$^{-1}$ mole^{-1}), or by plotting log k against the reciprocal of absolute temperature (1/T), the slope of the resulting straight line being equal to $-\Delta E/2.303$ R.

Since for first order decomposition k = 0.693 $t_{1/2}$ (where $t_{1/2}$ = half-life), ΔE can be calculated from the slope of the line obtained by plotting log $t_{1/2}$ versus the reciprocal of the absolute temperature. The degree of slope of these lines (Fig. 1 and 2) is a direct qualitative measure of the activation energy associated with each peroxide. As a practical approach, one can say that peroxides with high activation energies will decompose over a narrower temperature range than those with low activation energies. The implication of this is that a peroxide with a high activation energy will give a larger number of free radicals in a given temperature range than one with a low activation energy. If one requires an initiator that will show a rather narrow decomposition range, then a high activation energy is desired. If a slow, gradual decomposition is required, a low activation energy would be the answer.

Conclusions

Although activation energies and relative peroxide activities can be radically changed by the introduction of a specific accelerator, the half-life data, scale of activity, and activation energies here presented give the basic information needed for the choice of an effective initiator for any free radical polymerization system.

It is realized that all problems in the selection of a suitable organic peroxide initiator will not be solved as a result of this work, but it is hoped that the data presented will provide the groundwork for further catalytic activity studies applied to both single and multicomponent systems in inert solvents, monomers, and in the more complex polyesters. Preliminary work is being carried out using a representative polyester resin of known composition as a standard for relative catalytic activity measurements. Data developed with this type of system should be even more directly applicable to the polyester systems now used by various fabricators in the reinforced plastics industry.

The authors express their appreciation to Dr. F. Visser 't Hooft, President, Lucidol Division, Wallace & Tiernan, Inc.; Charles H. Rybolt, Director, Chemical Divisions, Wallace & Tiernan, Inc.; and Dr. James B. Harrison, Chief Chemist, for offering many helpful suggestions.—END

Table IV: Decomposition temperatures of succinic acid peroxide and benzoyl peroxide in acetone at selected half-life values

Peroxide	*Temp. for $t_{1/2}$ = 1 min.*	*Peroxide*	*Temp. for $t_{1/2}$ = 10 hr.*	*Peroxide*	*Temp. for $t_{1/2}$ = 100 hr.*
	°C.		°C.		°C.
Benzoyl peroxide (benzene)[a]	133	Succinic acid peroxide	66	Succinic acid peroxide	44
Benzoyl peroxide	134	Benzoyl peroxide	68	Benzoyl peroxide	48
Succinic acid peroxide	144	Benzoyl peroxide (benzene)	72	Benzoyl peroxide (benzene)	54

[a] For comparison, results are included for the decomposition of benzoyl peroxide in benzene (see Table II).

WORLD-WIDE PLASTICS DIGEST

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Properties of materials—plastics and rubber. Materials in Design Eng. *48*, 140-81 (Mid-October 1958). (Materials Selector). The physical properties, mechanical properties, electrical properties, fabricating properties, heat resistance, chemical resistance, and uses of most plastics materials are presented in tabular form. Included are both unfilled plastics and combinations with various fillers.

Search for high temperature elastomer. W. Postelnek. Ind. Eng. Chem. *50*, 1602-07 (Nov. 1958). The properties of some recently developed temperature-resistant plastics and synthetic rubbers are described. These materials are silicon and fluorinated organic compounds. 17 references.

Surveying modern adhesives. E. Bearman. Adhesives Age *1*, 16-22 (Oct. 1958). The theory of adhesion and types of adhesives are reviewed briefly.

Reinforced and laminated plastics survey. Insulation *4*, 8-11 (June 1958); 26-7 (July 1958); 54-5 (Aug. 1958); and 52 (Sept. 1958). A survey was conducted of manufacturers of electrical and electronic components and equipment. The results of 2259 replies are presented in tabular form and include desired improvements in reinforced laminated plastics, forms in which the plastics are used, sources of the materials, applications, grades of materials used, extent of use of NEMA, Military or ASTM Standards, and attitudes toward producers.

Materials

Synthesis of metal-complexing polymers. I. Phosphorylated polymers. J. Kennedy, E. S. Lane, and B. K. Robinson. J. Appl. Chem. *8*, 459-64 (July 1958). Phosphorylated allyl ester monomers and polymers were synthesized for use as ion-exchange resins in the purification of metals. Cross-linked chloromethylpolystyrene, polyvinyl chloride, and cannel coal were successfully phosphorylated by the use of phosphorus trichloride and aluminum chloride, the latter acting as a Friedel-Crafts catalyst. Some of the factors relevant to allyl ester polymerization, and techniques for phosphorylation of a phenolformaldehyde resin are described. Alkaline hydrolysis of allyl ester polymers yielded monobasic resins having a sodium-hydrogen exchange capacity of 4.5 mequiv. per g. of acid resin. Oxidative hydrolysis of chloromethylpolystyrene-based materials yielded a dibasic resin having an over-all exchange capacity of 8.5 mequiv. per gram.

Polyurethane foams. H. K. Frensdorff. Rubber Age *83*, 812-18 (Aug. 1958). Non-polymerizing model systems based on polytetramethylene-ether glycol were used to study some of the physical factors affecting foaming behavior of polyurethanes. Three silicon fluids were evaluated as additives in foams. These materials were found, because of their surface activities, to decrease bubble size and delay breaking of large bubbles, with a resultant decrease in the amount of foam collapse. Foam shrinkage due to the more rapid diffusion of carbon dioxide from the foam than diffusion of air into the foam could be controlled either by curing at a rapid rate compared to gas diffusion, or by the opening of the foam before a large pressure differential occurred.

Molding and fabricating

Labelling rubber and plastics. F. T. Day. Rubber and Plastics Age *39*, 587 (July 1958). Adhesives for bonding labels and markings to plastics are reviewed briefly.

Biological action of Fiberglas-plastic dust. G. W. H. Schepers *et al.* Archives of Industrial Health *18*, 34-57 (July 1958). Fiberglas-reinforced polyester resin plastic with calcium carbonate filler is used in building auto bodies. In an effort to determine the health hazards of this material, 140 guinea pigs, 36 rats, and 12 rabbits were exposed to inhalation of dust from this material over a 25-month period. The effects were gaged through studies of the animals during life, histopathological investigations, and by chemical determinations for retained silica in the lungs. No deaths could be ascribed to the dust although limited pulmonary reactions were produced in the guinea pigs. The inhaled dust sporadically and moderately stimulated tuberculous infection. Periodic health examinations for exposed personnel where this material is used in manufacturing operations are suggested.

Methods of fabricating laminated plastic printed circuits. A. Henesian. Insulation *4*, 77-80 (Sept.); 20-22 (Oct. 1958). Printed circuit fabrication methods are reviewed. The basic requirements for plastic baseplates are considered from civilian and military requirements. Of 35 or more methods for producing printed circuits, four stand out: electroplating, etching, photo-etching, and stencil-etching. Other aspects of fabrication and use which are covered include: etching solution saturation, dip soldering for mechanical and electrical assembly, choice of fluxes, metal foil-to-laminate bonds, and high-altitude voltage breakdown. Uses include missile applications and telemetry.

Processing system for optimum design use of casting resins. W. A. Gammel, Sr. Elec. Mfg. *62*, 80-83 (Sept. 1958). Several types of resin-handling equipment and systems in use for embedment, encapsulation, and potting of electronic circuits are discussed. The resins are prepared either by mixing a commercially available filled resin in a paint shaker or by blending hardener-filler combinations in a mill. Dispensing methods can vary from a gravity-fed system to semi-automatic equipment. Mixing and dispensing units are available commercially. The present trend in design is toward relatively small mixing chambers which insure thoroughness of mix and a continuously new supply of reactants. Various commercial machines are described in some detail. Molds are either integral, individual, or multicavity. Individual molds can be made out of either flexible materials or of low-melting-point metals. The curing of the resin in the mold and health and hazard considerations are also discussed.

Applications

Plastics hurl U. S. Navy torpedoes. Product Eng. *29*, 80-1 (Nov. 10, 1958). Construction of torpedo launcher, breech and tube (*To page 152*)

assembly from glass-fiber epoxy laminates is described. The breech assembly is subjected to 2000 p.s.i. and is constructed of filament-wound glass fibers and epoxy resin.

Springs that store energy best. K. W. Maier. Product Eng. *29*, 71-5 (Nov. 10, 1958). Springs of various design are discussed and equations given for factors such as shear strain and stress and volume efficiency. Glass-fiber laminates of unidirectional fiber pattern are found to have performance superior to steel springs.

Properties

Tensile strength of plastics: Effects of flaws and chain relaxation. F. Bueche. J. Applied Phys. *29*, 1231-34 (Aug. 1958). A theory for the tensile strength of amorphous plastics is presented. It extends a previous theory so as to include the effects of imperfections and chain relaxations. The result obtained shows that the time taken for a plastic to break, tc, under constant stress, *F*, is given by: $F = -B \ln (tc) + C$, where *B* and *C* are molecular constants. The experimental values found for these constants are shown to be consistent with their molecular interpretation. The extended theory shows that the effect of chain relaxations is the major time dependent factor as far as strength is concerned.

Thermal and oxidative degradation of silicones. L. C. Scala and W. M. Hickam. Ind. Eng. Chem. *50*, 1583-84 (Oct. 1958). Variously substituted silicones were exposed to the action of oxygen and heat to investigate the degradation reactions occurring at high temperatures in the presence of air. By using a sealed circulating system and a mass spectrometer, the rates of oxygen absorption by, and evolution of gases from methyl-, vinyl-, and phenyl-containing silicones were determined. Phenyl silicones were the most resistant to oxidation, followed by methyl- and vinyl-substituted silicones.

Polymers and the Kerr effect. Franklin Inst. Lab. Report *6*, 1-4 (Summer 1958). The electro-optical Kerr effect is shown to be useful for characterizing polymers in solution. The Kerr constant can be large for polymers. Activity increases as the electric field is increased to a saturation limit. A hysteresis effect on build-up in activity and decay on removal of the field is also observed.

Diffusion across interfaces in the system plasticizer-polyvinyl chloride. K. Heine, K. H. Hellwege

and W. Knoppe. Z. Angewandte Phys. *10,* 162–66 (Apr. 1958). The diffusion of dioctyl phthalate between samples of polyvinyl chloride was studied in the concentration range of 35 to 75% by weight of plasticizer at temperatures of 20 to 100° C. The plasticizer concentration was measured optically as a function of time. There is a time- and temperature-dependent jump in plasticizer content across the interface.

Testing

Analytical chemistry of plastics. VIII. Completion and improvement of analysis of polyamides. E. Schroeder. Plaste u. Kautschuk 5, 49–51 (1958). Qualitative methods for identification of polyamides are described.

Health safety of plastics. D. D. McCollister and W. J. Sauber. Plastics Tech. *4,* 812–14, 838 (Sept. 1958). Problems involved in the toxicology of plastic packaging materials for foods and the test methods used to study toxicity are discussed.

Chemistry

Polymerization of olefins by complex metal catalysts. J. K. Stille. Chem. Reviews *58,* 541–80 (June 1958). The literature on polymerization of olefins by complex metal catalysts is reviewed. The material is considered under the following headings: catalyst types, polymerization conditions, olefin types, stereochemistry of polyolefins, physical properties of polymers, and mechanism of polymerization.—END

Publishers' addresses

Adhesives Age: Palmerton Publishing Co., Inc., 101 W. 31st St., New York 1, N. Y.

A. M. A. Archives of Industrial Health: American Medical Assoc., 535 N. Dearborn St., Chicago, Ill.

Chemical Reviews: American Chemical Society, 1155 Sixteenth St., N.W., Washington 6, D. C.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York, N. Y.

Franklin Institute Lab Report: Franklin Institute, Philadelphia 3, Pa.

Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington, D. C.

Insulation: Lake Publishing Co., 718 Western Ave., Lake Forest, Ill.

Journal of Applied Chemistry: Society of Chemical Industry, 56 Victoria St., London S. W. 1, England.

Journal of Applied Physics: American Institute of Physics, 57 E. 55th St., New York 22, N. Y.

Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Plaste u. Kautschuk: VEB Verlag Technik, Unter den Linden 12, Berlin, N. W. 7, Germany.

Plastics Technology: Bill Brothers Publishing Corp., 386 Fourth Avenue, New York 16, N. Y.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.

Rubber Age: R. T. Vanderbilt Co., Inc., 230 Park Avenue, New York 17, N. Y.

Rubber and Plastics Age: Rubber and Technical Press, Ltd., Gaywood House, Great Peter St., London S. W. 1, England.

Z. Angewandte Phys.: Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany.

U.S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

Polymers. W. J. Maker (to Glidden). U. S. 2,852,487, Sept. 16. Polymerizable solution of an allyl ether and an unsaturated alkyd.

Polyolefins. G. A. Clark and C. B. Havens (to Dow). U. S. 2,852,488, Sept. 16. Stabilized polyolefins.

Resin. T. Anas (to Monsanto). U. S. 2,852,489, Sept. 16. Thermoplastic aminoplasts.

Resin. L. Sellet and W. O. Dawson (to Jacques Wolf). U. S. 2,852,490, Sept. 16. Dicyandiamide-formaldehyde-boric acid condensate.

Polyesters. J. R. Caldwell (to Eastman Kodak). U. S. 2,852,491, Sept. 16. Linear polyesters containing N-substituted amines.

Polyesters. J. L. R. Williams and T. M. Laakso (to Eastman Kodak). U. S. 2,852,492, Sept. 16. Polyesters from N,N'-bis(p-carboalkoxy-benzoyl) piperazines.

Polymers. D. A. Smith and C. C. Unruh (to Eastman Kodak). U. S. 2,852,493, Sept. 16. Ureido-modified polymers.

Polyureas. W. Lehmann and H. Rinke (to Bayer). U. S. 2,852,494, Sept. 16. Production of polyureas.

Polymers. J. H. Hunsucker (to J. I. Holcomb). U. S. 2,852,495, Sept. 16. Resinous polymers of di-ester monomers.

Polymers. J. R. Caldwell and E. H. Hill (to Eastman Kodak). U. S. 2,852,496, Sept. 16. Polymers of allyloxamic acid esters.

Polymers. G. Thompson (to Du Pont). U. S. 2,852,497, Sept. 16. Unsaturated sulfonamides of chlorosulfonated olefin polymers.

Terpolymers. D. B. Benedict, H. M. Rife, and R. A. Walther (to Carbide and Carbon). U. S. 2,852,499, Sept. 16. Terpolymers of vinyl chloride, vinyl acetate, and vinyl alcohol.

Copolymer. D. S. Alexander and I. R. Fraser (to Esso). U. S. 2,852,500, Sept. 16. Styrene-isobutylene copolymer production.

Polyethylene. W. R. Richard, Jr., R. K. Stewart, and J. D. Calfee (to Monsanto). U. S. 2,852,501, Sept. 16. Polymerization of ethylene.

Cellulose derivatives. C. L. Crane, J. Emerson, and G. D. Hiatt (to Eastman Kodak). U. S. 2,852,507-8, Sept. 16. Cellulose dicarboxylic acid esters.

Copolymers. N. G. Gaylord (to Interchemical). U. S. 2,853,462-3, Sept. 23. Compositions of acrylic polymers and an aminoplast resin.

Resin. M. H. Dilke and B. A. Ripley-Duggan (to Distillers). U. S. 2,853,464, Sept. 23. Polyester plasticized vinylidene chloride resin.

Resin. J. Werner (to General Aniline). U. S. 2,853,465, Sept. 23. Polyvinyl halide resin composition.

Resin. C. B. Havens (to Dow). U. S. 2,853,466, Sept. 23. Chloroethylene polymer composition.

Catalyst. A. Bloom and E. V. Welch (to General Aniline). U. S. 2,853,467-8, Sept. 23. Aromatic diamines as curing agents for epoxy resins.

Resins. P. L. Rosamilia. (to Harvel). U. S. 2,853,469-70, Sept. 23. Maleic acid-furfural-ketone reaction products.

Polymers. D. A. Beadell (to General Aniline). U. S. 2,853,471, Sept. 23. Addition copolymers.

Elastomers. H. E. Schroeder and J. M. Tinker (to Du Pont). U. S. 2,853,472, Sept. 23. Polyurethane elastomers cured with diisocyanates.

Copolymers. B. R. Thompson and H. A. Stasbury, Jr. (to Carbide and Carbon). U. S. 2,853,477, Sept. 23. Copolymers of vinyl chloride and 2-chloroallylidene diacetate.

Compositions. R. F. Nichols (to B. F. Goodrich). U. S. 2,854,422, Sept. 30. Diisocyanate-linked elastomers and lignin.

Composition. V. G. Boger and A. G. Thomas (to B. F. Goodrich). U. S. 2,854,425, Sept. 30. Composition of polyethylene and chlorinated polyethylene.

Resins. M. De Groote and K. T. Shen (to Petrolite). U. S. 2,854,427-8-9-30-1-2-3, Sept. 30. Aromatic polyepoxide resins.

Plastic. R. G. Beaman (to Du Pont). U. S. 2,854,434, Sept. 30. Shaped articles of a condensation polymer blended with a polymer of bis(2-chloroethyl)vinyl phosphonate.

Resins. J. R. Briggs, R. G. Newberg, and R. E. Clayton (to Esso). U. S. 2,854,435, Sept. 30. Polyethylene-polyisoolefin blends.

Polymers. P. J. Corbiere and P. Mosse (to Crylor). U. S. 2,854,436, Sept. 30. Acrylonitrile polymers.

Resins. R. Polansky and W. F. Herbes (to American Cyanamid). U. S. 2,854,437, Sept. 30. Sulfonated urea-thiourea resins.

Terpolymers. R. J. Slocombe and G. L. Wesp (to Monsanto). U. S. 2,854,439, Sept. 30. Clear terpolymers.

Copolymer. R. J. Kern (to Monsanto). U. S. 2,854,440, Sept. 30. Copolymer of acrylonitrile and cyano ether esters.

Sheet. W. H. Ryan (to Polaroid). U. S. 2,854,697, Oct. 7. Stretching plastic sheet.

Recording material. R. W. James (to A. D. Little). U. S. 2,855,266, Oct. 7. Heat-sensitive recording material.

Plastic. D. E. Field (to U. S.). U. S. 2,855,322, Oct. 7. Cellulose caprate.

Resins. R. W. Jenkins, G. A. Plew, and I. Katz (to North American Aviation). U. S. 2,855,372, Oct. 7. Ureamide-epoxide compositions.

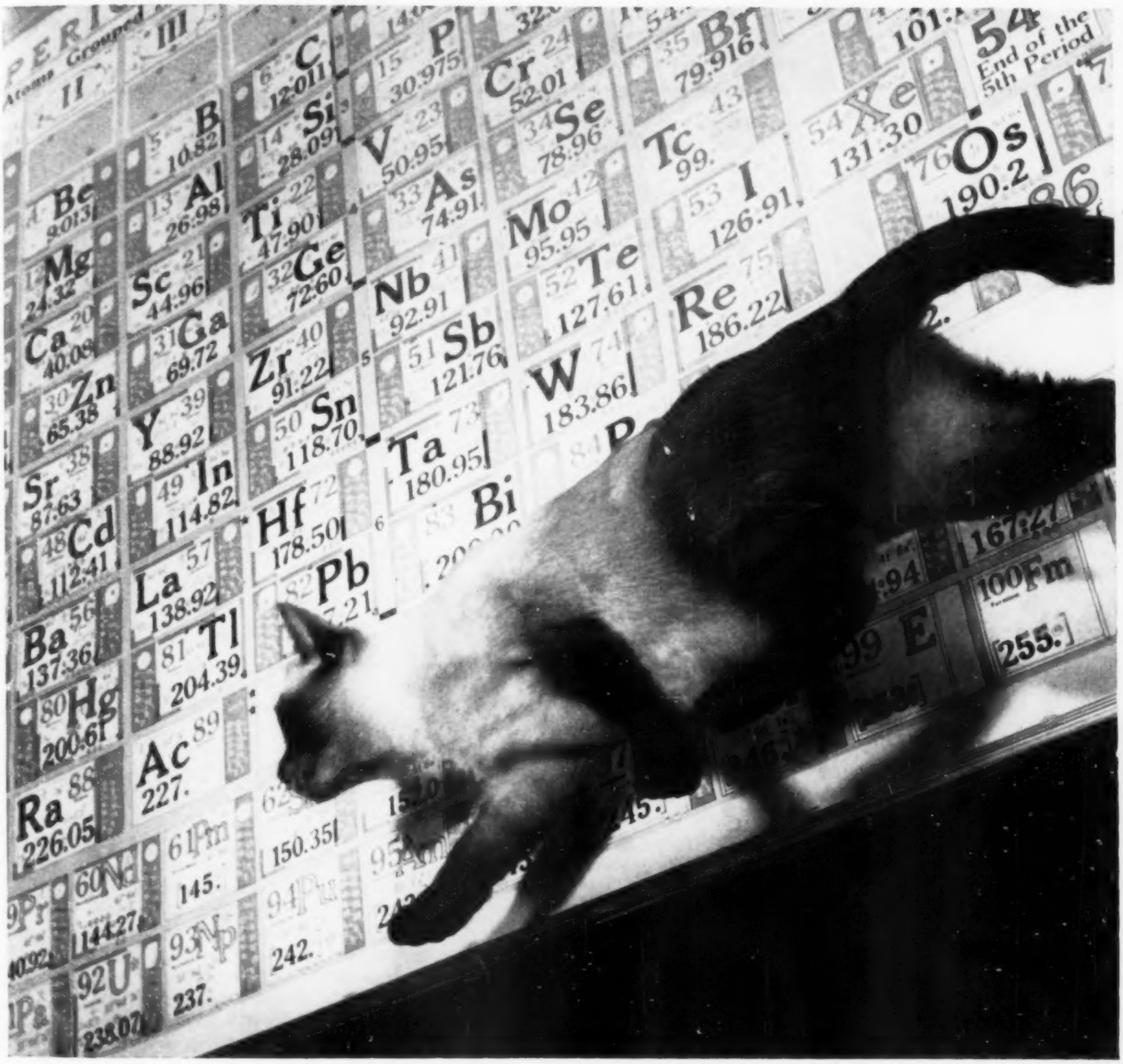
Resins. W. O. Herrmann, W. Haehnel, and H. Winkler (to Consortium für elektrochemische Industrie). U. S. 2,855,374, Oct. 7. Crotonic-acid-modified polyvinyl emulsions.

Polymers. D. G. Dobay (to B. F. Goodrich). U. S. 2,855,375, Oct. 7. Plasticized vinylidene cyanide polymers.

Resins. C. Heinen (to Chemische Werke Albert). U. S. 2,855,379, Oct. 7. Copolymers of vinyl monomers and unsaturated polyesters.

Resins. R. C. Hedlund (to Dow Corning). U. S. 2,855,380, Oct. 7. Organosiloxane resins containing indium carboxylate.

Resins. L. H. Sommer (to Dow Corning). U. S. 2,855,381, Oct. 7. Organopolysiloxane amides.—END



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LITERATURE

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"Adhesives and Sealants in Building" (Papers presented at the Building Research Inst. conference in Washington, D. C., Dec. 1957)

Published in 1958 by BRI, 2101 Constitution Ave., Washington 25, D.C. 160 pages. Price: $5.00.

This nicely produced collection of some 21 papers includes the slides shown by the speakers and the discussions that followed each group of papers. The conference was divided into five major parts: Introduction, Sealing exterior joints, Adhesives for interiors, Adhesives for structural materials and components, and the future of adhesives and sealants in building. Many of these materials contain plastics, some are used to bond plastics. There is much new info in this book for architects and builders. At the same time, producers of these materials may find these papers—and especially the discussions—stimulating to their future planning. Particularly provocative is Moderator Andrew Place's calculation that it costs him 11¢ per min. to keep a man on a construction job, and will adhesive and sealant makers please make things that can be applied quickly?—*J.F.C.*

"Plastics Applications Series:" Gum Plastics, *by M. S. Thompson,* **Epoxy Resins,** *by Irving Skeist.*

Published in 1958 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Respective pages: 193 and 293. Prices: $4.50 and $5.50.

"Gum Plastics" deals with, as its subtitle states, "Rubber-Modified Plastics." Three families of plastics are discussed: impact polystyrenes, ABS polymers, and blends of PVC and rubber. There are chapters on general properties, chemistry and manufacture, processing and fabrication, and applications. There are no literature references.

"Epoxy Resins" is full of specific and quantitative information. Chemistry and properties are worked into the smoothly written text where needed, and throughout the book the connection between properties and polymer structure is instructively kept in sight. There are 12 chapters covering background, resins, curing, flexibilizing, reinforcements and fillers, handling, tooling for metal working, structural applications, electrical embedments, adhesives, new developments, and an excellent chapter on coatings by G. R. Somerville. Over 300 literature references include material to mid-1958. This excellent little book could well be used as a model by authors of forthcoming books in the series—*J.F.C.*

"Chemical Engineering Catalog, 1959."

Published in 1958 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 1810 Pages. No charge in U. S. and Canada if volume is returned when new edition is published.

The 43rd annual edition of this comprehensive catalog, which is a completely indexed reference volume covering the chemical processing industries, offers a variety of useful information on the equipment available from hundreds of manufacturers.

Sheets, rods, and tubes. Catalog describes specifications, sizes, prices, etc., for Plexiglas, vinyl, acetate, phenolic, nylon, Teflon, Kel-F, polyethylene, polystyrene, and Rexolite sheets, rods, and tubes; fibrous glass reinforced panels; and coatings and accessories supplies. 64 pages. *Commercial Plastics & Supply Corp., 630 Broadway, New York 12, N. Y.*

Phenolic Products. Properties, features, molded properties, uses, etc., for a line of phenolic resins, varnishes, and molding powders. 8 pages. *Chemical Materials Dept., General Electric Co., 1 Plastics Ave., Pittsfield, Mass.*

Laminate. Characteristics, uses, properties, minimum and maximum property values for sheet stock, rolled tubes, and molded rods, etc., of Grade G-5, a continuous filament woven glass fabric base laminate bonded with melamine resin. Bulletin 4.5.1. 4 pages. *Taylor Fibre Co., Norristown, Pa.*

Polyethylene. "Polythene Coating and Laminating by the Extrusion Process" covers the process in detail and discusses extruder, adaptor, sheeting die, web handling equipment, laminator drive systems, instrumentation, operation of extrusion coating and laminating equipment, etc. 40 pages. *Bone Brothers, Ltd., Manor Farm Rd., Alperton, Wembley, Middlesex, England.*

Impregnated materials. Descriptive data on the research, development, and specialized facilities for making Fabricon plastic impregnated materials for laminating and molding. 20 pages. *Fabricon Products, 1721 W. Pleasant Ave., River Rouge 18, Mich.*

Skylights. Specifications, design data, construction features, size schedule, and other features of Marcolite aluminum and fibrous glass panel skylights. 12 pages. *The Marco Co., 45 Greenwood Ave., E. Orange, N. J.*

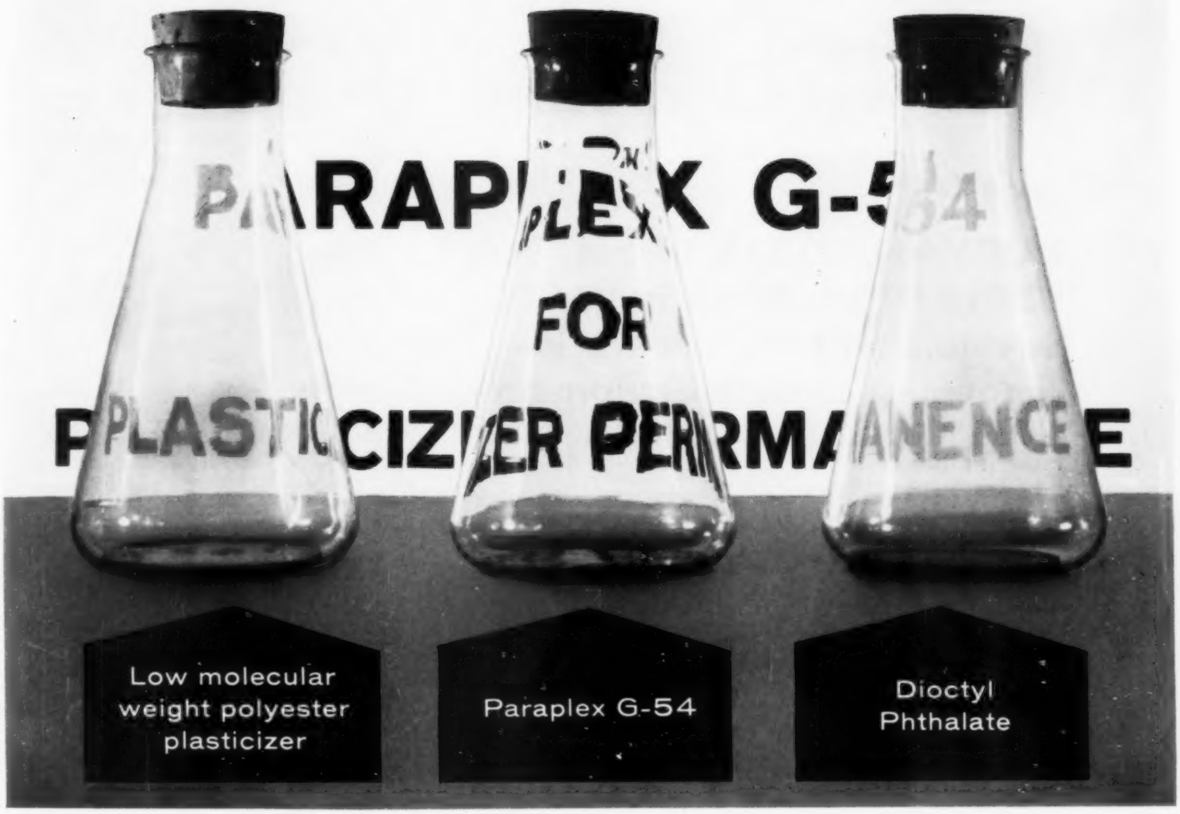
Releasing parchments. Technical data, testing samples, etc., for Patapar releasing parchments for polyurethane foams, polyesters, vinyl, organic adhesives, organosols, phenolics, acrylics, and synthetic rubber. 10 pages. *Paterson Parchment Paper Co., Bristol, Pa.*

Cold moldings. Describes development of Rosite, a cold-molding compound for non-tracking, arc quenching, heat resistance, and dimensional stability, including production and engineering facilities, uses, formulations, etc. Bulletin 200. 8 pages. *Rostone Corp., 2401 S. Concord Rd., Lafayette, Ind.*

Polyethylene. "Extrusion of Rigid Polyethylene Pipe" discusses extrusion conditions, with major emphasis on post-extrusion sizing techniques, and suggested applications. 6 pages. Technical information for a range of types of Marlex 5000 resins. 4 pages. *Phillips Petroleum Co., Bartlesville, Okla.*

Silicones. Properties, applications, formulations, etc., for Dow Corning Z-6018, a silicone intermediate, which reacts with a variety of organic resins to improve their heat stability, moisture and weather resistance. 16 pages. *Dow Corning Corp., Midland, Mich.*

Chemicals for the Creative Chemist. Physical and chemical properties, uses, availability, etc. of 18 intermediate chemicals—some commercial and others experi- *(To page 158)*



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mental—which have research possibilities in the plastics and other industries. 18 pages. *Commercial Development Dept., Naugatuck Chemical Div., U. S. Rubber Co., Naugatuck, Conn.*

Melamine dinnerware. Advantages, washing instructions, testimonials, etc., for melamine dinnerware. 8 pages. *The Melamine Council, 800 Second Ave., New York 17, N. Y.*

Molding presses. Specifications, advantages, safety equipment, etc. for line of Becker & Van Hüllen 10- to 315-ton plastics molding presses. 6 pages. *Karlton Machinery Corp., 210 E. Ohio St., Chicago 11, Ill.*

Molding powders. General characteristics, properties, and applications of two black and one brown heat-resistant, phenolic molding powders. Brochure CDC-355. 6 pages. *Chemical Materials Dept., General Electric Co., 1 Plastics Ave., Pittsfield, Mass.*

Power tools. Specifications, descriptions of accessories, applications, etc., for a line of power tools and accessories, for the plastics and other industries. Catalog AB-58-2. 88 pages. *Rockwell Mfg. Co., Delta Power Tool Div., 497 N. Lexington Ave., Pittsburgh 8, Pa.*

Thermoplastic resin. "A New World of Molding Applications" gives properties, advantages, uses, etc. for Cycolac high-impact thermoplastic resin. 8 pages. "A New World of Extrusion Applications." 8 pages. *Marbon Chemical, Div. of Borg Warner, Gary, Ind.*

Hobbing press. Capacities, general specifications, etc. of a hobbing press for multi-die work in the plastics and other industries. Bulletin 1030B. 4 pages. *American Steel Foundries, Elmes Engineering Div., 1150 Tennessee Ave., Cincinnati 29, Ohio.*

Injection machine. Design features, specifications, standard and optional equipment, etc. for a new 80-oz. capacity, preplasticating injection molding machine. Bulletin 58P80. 6 pages. *The Hydraulic Press Mfg. Co., Mount Gilead, Ohio.*

Vinyl acetate, acrylic. Properties, suggested uses, and other technical data for: Polyco 345 (Compounded vinyl acetate homopolymer dispersion); Polyco 346-LV (Polyvinyl acetate solution in Methanol); Polyco 350W (Butadiene-styrene latex); Polyco 497 (Alkali soluble vinyl acetate copolymer emulsion); Polyco 514W (Vinyl acetate ho-

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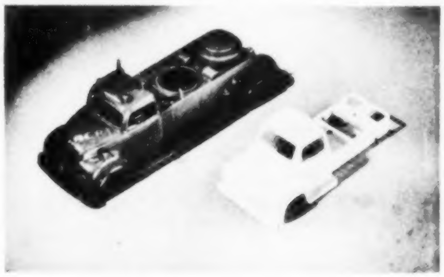

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mopolymer solution in Acetone); Polyco 684 (Polyvinyl acetate emulsion, Dextrine compatible); and EGD Monomer (ethylene glycol dimethacrylate). 1 page each. *The Borden Chemical Co., 350 Madison Ave., New York 17, N. Y.*

Testers and equipment. Specifications, applications, etc., for a line of 60 testing machines for plastics, adhesives, rubber, paper, cement, and other materials. Catalog 59. 12 pages. *Custom Scientific Instruments, Inc., Kearny, N. J.*

Fibrous glass panels. Doctoral thesis on "Production and Marketing of Fiberglass Panels in 1955." Available on inter-library loan from Deering Library, Northwestern University, Evanston, Ill., or microfilm purchased through the Microfilm Center, University of Michigan, Ann Arbor, Mich.

Disposable wipers. Specifications, in-plant applications, sample, etc., of Kimwipes disposable wipers, a lint-free paper wiper for the plastics and other industries. 12 pages. *Kimberly-Clark Corp., Neenah, Wis.*

For vinyl processing. Physical properties, applications, and other technical data for a line of stabilizers for the vinyl plastics industry—barium-cadmium (liquid and powder), barium-zinc, cadmium, epoxy, etc.; wetting agents; plasticizers; brighteners; etc. *Advance Solvents & Chemical Co., 500 Jersey Ave., New Brunswick, N. J.*

Precision sorter. Data on a machine said to gage and sort up to 300,000 parts per hour, with tolerances of ± 0.003-inch. 1 page. *U. S. Engineering Co., 49-24 22nd St., Long Island City 1, N. Y.*

Labels. Applications, advantages, samples, etc., of Able-Stik pressure-sensitive, no-moistening labels. 4 pages. *Allen Hollander Co., Inc., 385 Gerard Ave., New York 51, N. Y.*

Plastics for Electronics. Series of technical bulletins giving physical and electrical property data, applications, etc., for a variety of cements, adhesives, and sealants for use in electrical and electronic assemblies. 14 pages. *Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.*

Polyester film. Laboratory report on how polyester film can be used in heat-in-the-package food preparation. 5 pages. *Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.*—END

U.S. PLASTICS

Production and sales figures in 1000 lb.*
for September and October 1958

Materials	Total p'd'n first 10 mos. of 1958‡	Total sales first 10 mos. of 1958‡
Cellulose plastics:[a]		
Cellulose acetate and mixed ester:		
Sheet, under 0.003 gage	14,082	13,911
Sheet, 0.003 gage and over	15,173	14,538
All other sheets, rods, tubes (including other cellulose plastics)	7,558	6,752
Molding, extrusion materials (including other cellulose plastics)	73,865	71,944
Nitrocellulose sheets, rods, tubes	2,450	2,715
Other cellulose plastics[g]	3,056	2,209
Phenolic and other tar-acid resins:		
Molding materials[a]	131,191	129,367
Bonding and adhesive resins for:		
Laminating (except plywood)	53,543	34,567
Coated and bonded abrasives	10,317	9,167
Friction materials (brake linings, clutch facings, etc.)	10,510	9,881
Thermal insulation	39,072	39,268
Plywood	42,935	35,844
All other bonding uses	31,228	31,200
Protective coating resins	23,623	20,384
Resins for all other uses	25,482	21,132
Urea and melamine resins:		
Textile-treating resins	27,453	26,578
Paper-treating resins	21,960	19,421
Bonding and adhesive resins for:		
Plywood	79,884	80,472
All other bonding and adhesive uses, including laminating	35,781	32,095
Protective-coating resins	26,096	20,617
Resins for all other uses, including molding	74,291	72,742
Styrene resins:		
Molding materials[a]	347,271	367,669
Protective-coating resins	77,416	75,030
Resins for all other uses	129,167	103,684
Vinyl resins, total[b]	653,312	649,596
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		60,690
Sheeting (resin content)		53,292
Molding and extrusion (resin content)		172,300
Textile and paper treating and coating (resin content)		50,916
Flooring (resin content)		93,803
Protective coatings (resin content)		24,791
All other uses (resin content)		52,491
All other vinyl resins for:		
Adhesives (resin content)		40,242
All other uses (resin content)		101,070
Coumarone-indene and petroleum polymer resins	198,382	198,184
Polyester resins:		
For reinforced plastics	80,497	74,642
For all other uses	12,278	10,277
Polyethylene resins total:	702,948	676,545
For film		253,561
For all other uses		422,903
Miscellaneous:		
Molding materials[a,d]	35,479	36,132
Protective-coating resins[e]	14,176	6,856
Resins for all other uses[f]	119,513	105,572

*Dry basis designated unless otherwise specified.
†Revised.
‡Partially estimated.
[a]Includes fillers, plasticizers and extenders. [b]Production statistic by uses are not representative, as end use may not be known at th time of manufacture. Therefore, only statistics on total productio are given. [c]Includes data for spreader and calendering-type resin

PRODUCTION

From statistics compiled by the U. S. Tariff Commission.

September†		October‡	
Production	Sales	Production	Sales
1,295	1,428	1,238	1,369
1,716	1,820	1,620	1,641
936	771	859	900
8,215	8,067	10,035	9,808
223	206	271	277
g	g	g	g
15,341	15,388	18,685	16,898
6,615	4,638	7,336	3,747
1,061	†1,016	1,411	1,284
1,337	1,321	1,613	1,317
4,376	4,327	4,203	4,394
5,041	4,401	5,387	4,274
3,162	†3,282	4,150	4,122
2,557	2,207	2,930	2,346
2,966	2,584	3,420	3,679
2,981	2,846	3,451	3,117
2,349	2,221	2,497	2,239
10,404	9,918	10,440	10,762
4,355	3,783	4,662	3,919
3,197	2,658	4,021	2,728
8,212	7,796	9,045	9,490
40,361	41,122	43,733	46,286
8,290	8,034	9,020	8,461
14,896	12,052	15,120	12,309
82,133	75,493	88,551	86,520
	6,696		7,358
	†6,971		6,975
	†20,029		23,989
	6,194		7,116
	10,340		11,555
	2,370		2,528
	7,236		8,580
	4,308		4,859
	11,349		13,560
20,492	20,226	24,106	24,205
7,337	7,144	9,294	8,302
1,394	1,422	3,140	1,608
75,252	85,158	79,309	84,130
	25,421		30,045
	59,736		54,085
4,229	4,561	5,033	4,859
2,117	705	2,006	705
11,587	10,959	14,353	13,093

[d] Includes data for acrylic, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f] Includes data for acrylic rosin modifications, nylon silicone, and other plastics and resins for miscellaneous uses. [g] This classification discontinued in May and this material, mostly ethyl cellulose, reported in sheets and molding material.

Methacrylate in instrument for heart surgery

Formed acrylic shells and injection molded acrylic discs are being used with great success and significant cost savings in a new blood oxygenator (artificial lung) for use during open heart surgery. Former equipment of this type was fabricated of stainless steel, cost over $1000, and required considerable preparation to insure sterility before each use. Generally two full working days for one technician were necessary for these preparatory procedures, plus the time of an operating room nurse to carefully supervise the steam sterilization process.

The new acrylic unit, developed by Drs. William G. Esmond and R. Adams Cowley of the Dept. of Surgery, University of Maryland School of Medicine, is fabricated by Fawn Plastics Co., Timonium, Md., using Rohm & Haas Plexiglas. So inexpensive that it can be used once and then discarded, the acrylic oxygenator is delivered to the operating room in a package, sterile and ready for immediate use.

Building "previews" with acrylic models

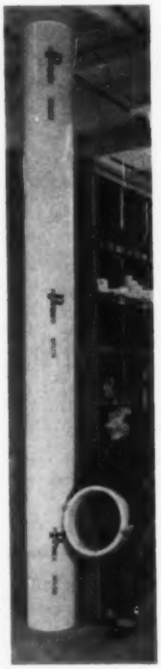
Precisely scaled models of office buildings, fabricated largely of acrylic and aluminum from architects' blueprints, are in increasing demand by building owners for very practical purposes. They show the architect's client exactly what he is going to get and how it will look. They are helpful in advance planning of lighting and maintenance layouts. They serve to show prospective tenants the advantages available. They fit dramatically into all kinds of promotion and public relation programs. And they do all this with far greater impact than even the best drawings.

Typical of these models (see photo) is that of the new Equitable Life Building now being erected in New York, N. Y. It was built by Theodore Conrad, Jersey City, N. J., who has created similar precise replicas of most of the recent big buildings constructed in Manhattan. Source of Mr. Conrad's plastics materials, which are mostly acrylic, is Commercial Plastics & Supply Corp., New York, N. Y., distributor of plastics rod, sheet, tube and other shapes. Of particular importance in model building is the fact that the company can meet short delivery notices. Mr. Conrad states acrylic is safer to handle, lighter in weight, and easier to fabricate than glass, the material used in his earlier models.—END

ASSEMBLING SECTIONS of ¼-in. scale model of Equitable Life Building, fabricated largely from precisely machined acrylic parts.

Nylon monolith

Weighing over 700 lb. and measuring 21 ft. long, giant nylon cylinder produced by The Polymer Corp., Reading, Pa., has an outside diameter of 16 in. and an inside diameter of 13 inches. According to the company, this is the largest monolithic nylon shape ever manufactured.



These cylinders are suggested for use primarily as roller coverings to impart nylon's abrasion resistance, resilience, and surface characteristics in such applications as embossing, coating, and similar processing of paper, textiles, vinyl, and other sheet materials. Roller coverings for forming metal strip are also of particular interest, since the nylon is said not to gall or scratch prefinished metal surfaces.

Other applications foreseen by Polymer include large journal bearings, tires for industrial materials-handling equipment, and housings for circuit breakers. The cylinders can reportedly be fabricated on metalworking equipment.

No details on how these cylinders are produced are available for publication. Polymer states, however, that the process used in making the 16-in. O.D. variety can also be employed in producing cylinders with outside diameters up to 48 inches, and that virtually any wall thickness greater than 1 in. can be made available. The production of diameters greater than 16 in. will require additional equipment, but Polymer indicates that it is prepared to undertake such tooling when uses are developed.

The new shape can be supplied in a number of specialty nylon formulations tailored to specific end-use requirements.—END

Plasticizer Data
TO HELP YOU CHOOSE THE RIGHT PLASTICIZER

these Harflex® Polymeric Plasticizers are permanent

Harflex 300 polymeric plasticizer

non-migratory
fast processing
excellent dry blending
good low temperature properties
can be used as sole plasticizer

physical data

100% Modulus	1320 psi
Tensile Strength	2695 psi
Elongation	338%
Hardness, Shore A	80
T_f	—17.3°C.
Flux Time	45 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

Water	0.21%
1% Soap	3.45%
Mineral Oil	2.10%

migration

Lacquer, 25°C., 14 days	Very slight softening
Varnish, 25°C., 14 days	No effect
Polystyrene, 60°C., 19 days	No effect

Harflex 325 polymeric plasticizer

economical
non-migratory, permanent

physical data

100% Modulus	1320 psi
Tensile Strength	2471 psi
Elongation	350%
Hardness, Shore A	76
T_f	—12.5°C.
Flux Time	60 seconds

heat stability (180°C.)

Initial Discoloration	15 min.
Maximum Discoloration	90 min.

extraction loss

1% Soap	2.6%
Mineral Oil	1.2%

migration

Lacquer, 25°C., 14 days	Slight staining, very slight softening
Varnish, 25°C., 14 days	Slight staining
Polystyrene, 60°C., 19 days	No effect

Both these Polymerics are used with Vinyl Chloride Polymers and Copolymers, Polyvinyl Acetate, Synthetic Rubbers, Nitrocellulose, Cellulose Acetobutyrate, and Polymethyl Methacrylate.

Harchem produces a full line of phthalate, adipate, sebacate and polymeric plasticizers in addition to the plasticizers shown.
The Harchem Division laboratories will gladly assist you with your plasticizer problems, or will supply additional data including formulation test methods and formulation suggestions for any Harflex Plasticizer.

Address inquiries to Dept. H-42.60

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EQUIPMENT · SUPPLIES · SERVICES

VINYL STABILIZER. 4-page brochure describes a vinyl stabilizer said to minimize performance variations due to resin or plasticizer or filler; and to eliminate storage problem due to exposure of stabilizer or compound to oxidation or moisture. The Harshaw Chemical Co. (B-901)

MATERIAL CONVEYOR. 4-page illustrated folder describes a mechanical material conveyor for the automatic conveyance of molding powders, pellets and granules to molding presses and extruders. The Oakes Manufacturing Co., Inc., Subsid. Food Mach. & Chem. Corp. (B-902)

PLASTIC MOLDINGS. 8-page illustrated brochure describes this company's services and facilities for making custom engineered cold and hot molded products, possessing desirable heat resistance, nontracking, arc quenching and dimensional stability properties. Rostone Corp. (B-903)

PLASTICS CUTTERS. Illustrated 4-page brochure describes this company's lines of machines for dicing sheet plastics, pelletizing plastics extruded in rods and cutting staple and flock. Units have a useable throat width of six inches. Taylor, Stiles & Co. (B-904)

TEMPERATURE REGULATORS. 4-page illustrated folder describes features and operation of new transistorized amplifier relays for precise temperature control in molding, extruding and other plastics processing operations. Brown Instrument Div., Minneapolis-Honeywell Regulator Co. (B-905)

GERMAN-BUILT MOLDS. 4-page illustrated brochure describes this company's services for designing injection molds, and also its facilities for building the molds in Germany. Alfred A. Rosenthal. (B-906)

POLYETHYLENE. Series of illustrated brochures describes this company's grades of polyethylene for use in the manufacture of plastic films, textiles, food packaging, food cartons, polishes, color concentrates, etc. Semet-Solvay Petrochemical Div., Allied Chemical Corp. (B-907)

MULTI-LINE IMPRINTER. Technical data sheets describe a table model multi-line imprinter for use with most plastics, cloth, paper, etc. Machine accommodates five 12 pt. lines or any combination from 12 to 36 pt. Franklin Manufacturing Corp. (B-908)

REINFORCED PLASTICS PRODUCTS. Series of illustrated brochures describe this company's drafting, research, testing, mold making and molding facilities for the manufacture of molded fiberglass reinforced parts and sandwich structures. Vinner Manufacturing Co., Inc. (B-909)

VINYL RESINS FOR RIGID APPLICATIONS. 8-page illustrated brochure gives the physical properties of two grades of vinyl resins along with Banbury and mill mixing, and extrusion processing conditions. B. F. Goodrich Chem. Co. (B-910)

METERING & MIXING SYSTEMS. Technical data sheet describes automatic equipment designed for deaeration, proportional metering, mixing and metered dispensing of epoxies, polyesters, polyurethanes, polyamides, etc. Mitchell Specialty Div., Industrial Enterprises, Inc. (B-911)

ELECTRIC MOTORS. 16-page illustrated brochure describes this company's drip-proof, totally enclosed and explosion-proof electric motors over the full 125-horsepower range. Small AC Motor and Generator Department, General Electric Co. (B-912)

DIAMOND SAWS. Technical data sheet lists specifications for this company's diamond saws for sawing reinforced plastic laminates such as epoxy, melamine, fiberglass, polyester, etc. W. F. Meyers Co., Inc. (B-913)

EXTRUDERS. 4-page illustrated brochure describes this company's line of extruders ranging in size from 1½ to 6 inches. Machines feature oversized feed opening to prevent clogging of the feed section; also oversize thrust assembly and screw support bearings for longer life. JMC (B-914)

DECORATIVE MARKING MACHINES. Catalog carries descriptions and prices of lines of hand-operated bench models, air- and motor-driven bench and floor models, etc., for the marking of molded or fabricated thermoplastics and thermosets. The Acromark Co. (B-915)

DISPOSABLE WIPERS. 12-page illustrated brochure describes lines of high-absorbent cellulose wipers for wiping fine finishes and precision parts, plastic goggles, all-plastic boats, etc. Kimberly-Clark Corp. (B-916)

DATA AND CONTROL SYSTEMS. Illustrated 8-page brochure describes special industrial computers and data readout equipment for plastics processing operations. Units are said to reduce start-up and order change time, improve uniformity and save raw materials. Industrial Nucleonics Corp. (B-917)

UREA. 4-page brochure gives physical properties of this company's grades of urea; lists uses in the manufacture of resinous materials, chemicals, etc. Grace Chemical Co. (B-918)

ADHESIVES AND TAPES. 4-page illustrated brochure describes this company's lines of adhesives, available in liquid and paste forms for bonding of plastic, wood, clay, etc., parts. Furane Plastics, Inc. (B-919)

RESINS. 20-page illustrated brochure describes this company's fluorocarbon, nylon, polyethylene and acrylic resins. Discusses properties, characteristics and applications. E. I. du Pont de Nemours & Co., Inc. (B-920)

ACRYLONITRILE. 76-page bulletin discusses the polymerization and copolymerization of acrylonitrile, a versatile, reactive vinyl monomer. The bulletin includes monomer reactivity ratios and their utilization and designing experimental procedures. Petrochemicals Dept., American Cyanamid Co. (B-921)

REDUCED VOLTAGE STARTERS. 12-page illustrated brochure describes this company's lines of automatic reduced voltage starters, 50 to 1,200 h.p., 600 volts. Starters are engineered for control of large conveyors, large fans, pumps, etc. General Products Div., Allis-Chalmers. (B-922)

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EQUIPMENT · SUPPLIES · SERVICES

POLYPROPYLENE. 14-page illustrated booklet describes the features and properties of, and processing procedures for, applications of this company's "Moplen" polypropylene for pipe, foil and film, electrical, home, automotive and sanitary products. Montecatini. **(B-923)**

PVC PLASTISOL MOLDING MACHINE. 2-illustrated brochures describe a machine that molds up to 1620 PVC seamless hollow parts such as toys, bottles, etc., per hour. Brochures also contain extensive background information on plastisol molding procedures. The Akron Presform Mold Co. **(B-924)**

PROCESSING POLYETHYLENE. Companion illustrated brochures, one 96 pages and the other 12, serve as processing guides to extruders, injection molders, bottle blowers and other converters of polyethylene. The larger publication describes processing technology while the smaller contains the latest information on polyethylene resins available from this company. U.S. Industrial Chemicals Co. **(B-925)**

GLASS FABRICS. 31-page handbook discusses properties, construction, processing, finishing, etc., of this company's grades of glass fabrics for electrical, boating, tooling, etc., applications. United Merchants Industrial Fabrics. **(B-926)**

LIQUID CHILLERS. Illustrated data sheet describes this company's line of self-contained, air- and water-cooled liquid chillers for cooling injection molding, embossing, extrusion and laminating equipment. VIC Mfg. Co. **(B-927)**

NEW THERMOPLASTIC POLYMER. 6-page technical bulletin describes a new, high molecular weight, linear and crystalline chlorinated polyether said to be highly resistant to thermal degradation at molding and extrusion temperatures. Cellulose Products Dept., Hercules Powder Co. **(B-928)**

METALLIZED THERMOPLASTIC SHEETING. Color card shows available metallic colors on this company's plastic sheeting. Accompanying bulletins describe vacuum forming of acetate and butyrate sheeting. Gomar Mfg. Co., Inc. **(B-929)**

PHENOLICS MOLDING COMPOUNDS. 14-page illustrated brochure discusses the manufacture, molding, physical properties of this company's phenolic molding compounds; also the design and finishing of end products. Durez Plastic Div., Hooker Electrochemical Co. **(B-930)**

BIMETALLIC CYLINDERS. 16-page illustrated brochure describes the physical properties and performance features of this company's bimetallic cylinders, used in extruders. Also describes production facilities and available services. Industrial Research Labs., Div. of Honolulu Oil Corp. **(B-931)**

POLYMERIC PLASTICIZERS. 12-page technical bulletin describes a polymeric plasticizer for use in the manufacture of PVC electrical wire coatings and tapes, film and sheeting and adhesive-backed film and sheeting. Organic Chemicals Div., Monsanto Chemical Co. **(B-932)**

FINISHING EQUIPMENT. 8-page illustrated catalog describes this company's lines of multi-spindle rotary finishers for finishing circular molded or machined parts; also a rotary edger for trimming, buffing and polishing melamine dinnerware. J. M. Nash Co., Inc. **(B-933)**

EXTRUDERS. 4-page illustrated brochure describes this company's lines of extruders, ranging from one-in. laboratory bench models to 15-in. machines with automatic die head clamps. Also lists available "packaged" insulations, dies and accessories. National Rubber Machinery Co. **(B-934)**

ROTARY PLASTIC MOLDING PROCESS. 4-page illustrated brochure describes the design and performance features of this company's 10- and 30-station automatic rotary plastic molding presses. Single 30-station press can mold up to 90 separate plastic parts per min., with triple-cavity molds. New England Butt Co. **(B-935)**

INJECTION MOLDING MACHINE. Illustrated data sheets describe features of an automatic 2½-oz. horizontal plastics injection molding press, that plasticizes over 30 lbs. per hr. Includes specifications, price data. The Van Dorn Iron Works Co. **(B-936)**

ORGANIC PEROXIDES. 8-page bulletin lists available organic peroxides for use as catalysts with vinyl, polyester, silicone and epoxy resins. Lucidol Div., Wallace & Tiernan, Inc. **(B-937)**

ROLLER BEARING SERVICE. 4-page illustrated brochure outlines this company's services for assisting machinery builders in all aspects of bearing application engineering. The Timken Roller Bearing Co. **(B-938)**

CUSTOM MOLDING. 14-page illustrated brochure describes this company's facilities for injection, compression and transfer molding with all major types of plastic materials. Sylvania Electric Products, Inc. **(B-939)**

MOLDABLE INSULATING BASE. 10-page technical bulletin describes a phenolic impregnated, cellulose fiber sheet used as an insulating base in molded printed wiring board. Rogers Corp. **(B-940)**

MEDIUM IMPACT POLYSTYRENE. Technical data sheets describe this company's medium impact polystyrene, developed for the indoor fluorescent lighting and sign industry. Material reportedly solves problem of discoloration due to the ultraviolet of flourescent light bulbs. Sheffield Plastics, Inc. **(B-941)**

REINFORCED PLASTICS. Data sheets give chemical, electrical, and thermal properties of reinforced plastics materials used in the manufacture of rockets, missiles and aircraft. Raybestos-Manhattan, Inc. **(B-942)**

TEMPERATURE CONTROLS. 8-page catalog gives specifications and prices for this company's lines of recording, indicating and non-indicating controls; thermometers, bulb installation accessories and mercury bulb elements, etc. Instruments are used in industrial heating and refrigeration. The Partlow Corp. **(B-943)**

SHEETS, RODS, TUBES. 8-page illustrated catalog lists specifications for this company's nylon, polystyrene, Teflon, and chlorinated polyether rods, tubing, sheets, bars, strips and tapes, etc. The Polymer Corp. of Pa. **(B-944)**

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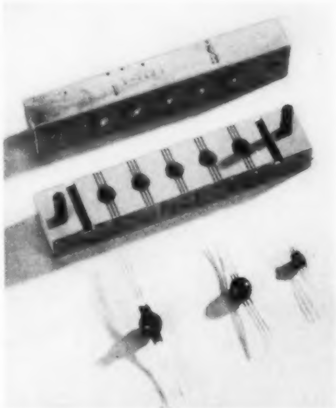
...odrich Chem. Co. (B-910)

TFE for casting molds

The low coefficient of friction of Teflon tetrafluoroethylene (TFE) resin, which has long provided the solution to sticking problems in the baking, textile, paper, and packaging fields, is also being put to excellent use by the plastics industry itself: applied to production rolls, the coating is improving the operations of calenders and embossers; applied to certain parts of extrusion and injection molding equipment, it helps facilitate material flow.

A new plastics application for Teflon is in the coating of molds for epoxy casting. A typical firm using the coating for this purpose is United Transformer Co., New York, N. Y. Before the company began using Teflon, the highly polished aluminum dies used for encapsulating transformers and other electrical components had to be treated with a baked-on silicone coating. This coating was effective for only about 30 cycles; then the molds had to be cleaned, polished, and re-treated. This procedure was very disruptive of tight production schedules.



TEFLON-COATED aluminum mold, used to produce epoxy-potted pulse transformers (foreground) allows quick, clean release.

Under the new method, United has its molds Teflon-coated by General Plastics Corp., Paterson, N. J., a Teflon coating specialist serving many industries. The Teflon, supplied by Du Pont in dispersion form, is sprayed on the parts in half-mil (*To page 173*)

TRANSFORMER (center) is epoxy-encapsulated in four-part Teflon coated mold. Coating facilitates removal of finished piece.

coats and fused at a temperature of 700° F. (Size is no limitation in Teflon coating; General Plastics has successfully coated paper mill driers weighing five tons.)

For United Transformer's molds, a 3-mil coating was decided upon. This coating lasts four times as long as the previous material; gives a cleaner release.

Cost is minimal. For instance, the coating for the larger mold illustrated above costs only $15. This outlay paid for itself with the first few molding cycles.

In potting the transformers, the electrical parts are first placed in the mold. Then the molds are filled with liquid epoxy resin, under vacuum, to eliminate voids in the casting. The epoxy is cured in an oven, with bake time and temperature depending on formulation.

Alkyd housing for water heater

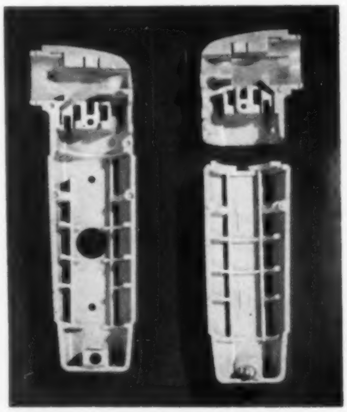
Greater safety, lighter weight, and improved appearance have been achieved in a household faucet-type water heater by replacing the metal housing by one molded of Plaskon reinforced alkyd. The material withstands temperatures in excess of those encountered in the application and provides excellent electrical insulation. The heater, available in 120 and 220 v., a.c. only, is made by Landam Products Corp., Great Neck, N. Y.—END

FLASH UNIT molded of methylstyrene acrylonitrile copolymer compound matches gray color of metal camera.

Flash attachment

An attractive and sturdy plastic camera flash attachment is molded by Ansco Div., General Aniline & Film Corp., Binghamton, N. Y. Designed for use with two cameras of Ansco's line, the unit is molded of methylstyrene acrylonitrile copolymer compound from American Cyanamid Co.

Properties of the material which make it particularly suitable for this application are its good dimensional stability—which makes it resist warpage and insures a continuing tight fit—and stain and perspiration resistance. The attachment is assembled of three injection moldings and metal reflector.—END



THREE PLASTIC PARTS containing complex reinforcing ribs, cutouts, and bosses, provide space for batteries and reflector.

Specialized baths

(From pp. 98-99)

are the contoured seat and back, made in the same optional colors, the seat base, which forms a plenum chamber and mounting for the two heater-blowers, and a removable baffle plate which fits in the base. Openings cut in the sides and rear of the base of the Monobath after molding exhaust heated and humidified air, providing a uniform circulation through the entire cabinet.

How they are made

In molding these parts, De Lucien first sprays a PVA-type mold release on the reinforced plastic mold, following it up with a gel coat. Using glass cloth or mat, the contact layup is then made and impregnated, with the reinforcing material tailored for a smooth surface on the compound-curved surfaces. Wall section of the parts is approximately 1/8 inch. Parts are cured at room temperature.

The mold for the Monobath cabinet is made in two parts to facilitate removal of the cabinet component. Finishing operations on the cabinet include drilling holes around the edge of the opening for attachment of an aluminum molding which hold a nylon fabric cover. The cover has a long zipper, which can be manipulated from either within or outside the cabinet, and facilitates entry and egress of cabinet occupant.

De Lucien spokesmen state that, if the Monobath cabinet were made of metal, it would have to be constructed in two halves rather than in one piece. For each stamping, dies run in a double acting mechanical press would be required. These would be followed by flanging dies, to turn the edges, and trimming dies. Parts would then have to be welded together or joined in some other manner, necessitating additional operations. Finally, some type of paint or other finish would have to be applied to the metal. However, it is doubtful that any type of surface color would long endure the heat cycling of up to 135° F. involved in operation of the Monobath.—END

Polyethylene

(From pp. 103-105)

the density was generally from 0.914 to 0.916 with an MI that was around 1. Since then other varieties have been introduced.

One company now markets eight different grades of wire coating material all with a density of 0.923, but the MI for four of them is 1.7, for three others it is 0.3, and for the eighth it is 1. Resins with a melt index of 0.3 sell for 42½ and 46½ cents. The lower melt index generally means that the resin is a bit slower in running through the extruder, but also that it has certain upgraded properties such as toughness, less tendency to cut-through, higher temperature resistance, and better abrasion and stress crack resistance. This resin finds use in coating wire for telephone cable. The other varieties are used for field wire, drop wires, etc., where service conditions are not so severe. In some cases a 0.930 density material with an MI of 1.5 to 3.4 may be used for hook-up and tree wire where abrasion resistance and resistance to cut-through is essential. However, a good portion of the wire coating resin sold today is still from 0.915 to 0.918 in density, with melt indices under 2. The compound used for submarine cable, for example, generally has an MI of 0.3.

Foamed polyethylene

There is also a "coating" in the form of extruded polyethylene foam on wire. It consists essentially of joined "bubbles" of PE formed around the wire by use of an activating agent. It is made with a high-molecular-weight resin of very low MI and a density of perhaps 0.930. Telephone line wire is now frequently wrapped with paper, but users believe that foam may be used at half the cost if the speed of extrusion could be speeded up to come somewhere near the 2- or 3000-ft./min. possible with paper.

Ziegler producers of linear PE have developed various formulations of wire coating compounds which they insist will resist stress cracking because of their higher molecular weight. They assert that it will eventually take a great share of the market because its high density will permit use of thinner walls and still give superior cut-through and abrasion resistance. They maintain that it could also replace much of the conventional PE wire coatings that must be covered with vinyl or nylon jackets; they claim that high-density material would require no jacketing.

Phillips producers of linear PE ran into a little trouble early in the game because their wire-coating compounds had a tendency to stress-crack. Their competitors claimed the reason was largely a matter of molecular weight. However, the new series of Phillips-type 0.950 density resins is believed to have overcome this problem.

There is no doubt that every polyethylene coater in the country is extremely interested in high-density PE and expects to find it useful when they learn more about handling it.—END

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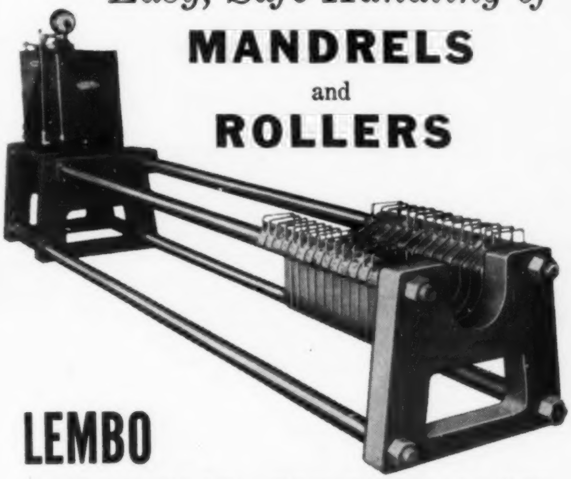

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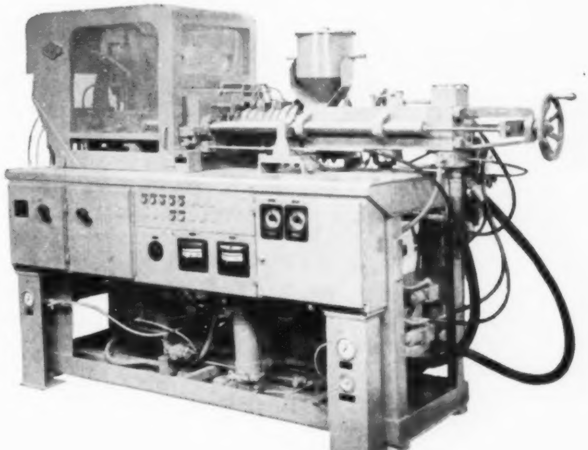

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THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 43)*

February 1959

Reinforced plastics growth

Sales of reinforced plastics reached the 185 million-lb. level in 1958, a 10% increase over 1957, according to a market study conducted by the Reinforced Plastics Div. of The Society of the Plastics Industry, Inc. The table below is a record of what the industry has achieved in the last two years.

It is particularly noteworthy that increased consumption in most of the industry's major markets offset the 12% drop in volume of sales under "Transportation" in the table—last year's biggest market. This drop reflects only the decline in automobile production during 1958.

Of the 185 million-lb. reported, resins accounted for 99 million lb.; reinforcement for 62 million lb.; and fillers, pigments, activators, etc., for 24 million pounds. Polyesters are still, by far, the dominant resin, but acrylics are growing in sheeting and paneling applications. Fibrous glass is still the leading reinforcement used in the industry.

Boats became the largest user of reinforced plastics during 1958, with 75% of the materials going into boat hulls. It is estimated that in the neighborhood of 72,000 reinforced plastics boats were produced last year, compared with between 45- and 50,000 craft in 1957. It is predicted that these materials will supply half the small boat market by the mid-1960's. Hulls of larger boats are also using more of these materials, and the Navy decided that all their boats 50 ft. and less in length will henceforth be made of reinforced plastics.

Architectural usage is still mainly confined to panels, which accounted for almost all the materials reported in the construction field. Volume increased an estimated 25% during 1958, reaching a total of from 57 to 62 million square feet.

Promising new developments include sheathing to simulate stone or brick; covering plywood, steel, and pulp boards with RP, and facings for concrete blocks.

Greater uniformity of color and thickness, and greater resistance to outdoor weathering of panels was achieved during the year. The industry also increased the number of distributors and dealers by about 15%; it is estimated that 2500 distributors and 30,000 dealers are now handling reinforced plastics panels.

Molded chairs and seats are now being made by a number of large companies, and this market for reinforced plastics is expected to show a very substantial increase during 1959. New surface effects are also expected to provide a bigger market for these materials in the luggage field. Many in the industry believe that reinforced plastics will make some of its greatest inroads in markets formerly dominated by die cast aluminum and molded plywood, particularly institutional seating.

Poundage in aircraft and missiles dropped in 1958, but the variety and number of different components made of these materials increased. The explanation might lie in the present transitional stage of air transportation and missiles.

The growing use of reinforced plastics in this field lies in the strength-weight ratio advantage over steel; good thermal and electrical insulation properties; and ease of fabrication of complex contours. Developments of applications in these fields are worth watching, as many of the industry's most important applications resulted from work in aircraft and missiles.

Reinforced epoxy resins—which were reduced 20% in price during 1958—are used mainly in the pipe, tank, and duct market. The reinforced plastics industry estimates that about 60%, or 3,326,400 lb. of the total reported for this field goes into pipe. In the electrical market, combinations of epoxy resin and paper seem to have a bright future.

The rate of growth pattern in 1959 is expected to return to 15%, which is expected to be due less to a general pickup in the overall economy than to *(To page 182)*

Table I: Progress of reinforced plastics

Major markets	*Estimated 1958 usage*	*Share of 1958 total*	*1957 usage*
	lb.	%	lb.
Aircraft and missiles	18,500,000	10	25,200,000
Appliances	7,400,000	4	5,040,000
Boats	37,000,000	20	25,200,000
Construction	31,450,000	17	25,200,000
Consumer products	24,050,000	13	25,200,000
Containers, trays industrial housings	7,400,000	4	5,040,000
Electrical	7,400,000	4	5,040,000
Pipe, tanks, ducts	5,550,000	3	3,360,000
Transportation	29,600,000	16	33,600,000
Miscellaneous	16,650,000	9	15,120,000
TOTALS	185,000,000	100	168,000,000

*Reg. U.S. Pat. Off.

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(From page 180)

the greater usage of reinforced plastics in its nine major fields of application.

PVAc price reductions

A price reduction of 2¢/lb., or about 11%, on all grades of Elvacet polyvinyl acetate emulsions was announced by Du Pont. New tank car prices are 16¢/lb. for homopolymer grades, and 18¢/lb. for the copolymer type.

Standard grades of Gelva PVAc emulsions, manufactured by Shawinigan Resins Corp., were also reduced 1 to 2¢ per pound.

These reductions make PVAc the lowest priced of the three most widely used latex resins for water-based paints, Du Pont states. The other two are butadiene-styrene and acrylics. Lower prices are expected to spur the use of these emulsions in grease-resistant coatings for paper and paperboard, adhesives, and textiles.

Colton Chemical Co., Div. of Air Reduction Co., Inc., reduced prices of its Vinac RP-250, redispersible polyvinyl acetate in powdered form by from 4 to 33%, depending on quantities ordered.

This form of PVAc can be used where a high percentage of moisture cannot be tolerated in a finished product, or in an intermediate stage of formulation or blending of dry materials. As an additive to concrete mixes, Vinac RP-250 powder is said to impart resiliency and improved adhesion to new concrete.

Slush molds polyethylene

Experience in molding wax candles, novelty items, etc., led W. & F. Manufacturing Co., Inc., Buffalo, N. Y., to develop its own process and machinery for slush molding polyethylene. The company now offers a custom molding service in this new technique, and also makes available the large stock of molds previously used for their wax products. Such items as mantelpiece decorations and display containers—Easter bunnies, turkeys, Santa Clauses, etc.—are among the products which W. & F. can custom mold frequently without the usual expenses for design, development, and molds.

(Slush molding of blends of low-molecular-weight and standard polyethylene resins was first discussed in MPL., May 1958, p. 112.)

Uses for alkyd molding compounds

Relays for International Business Machines Corp.'s 305 RAMAC data processing system are now molded from alkyd molding compounds manufactured by Glaskyd, Inc., 227 Eckel Rd., Perrysburg, Ohio.

The material is supplied in continuous rope form, and accurate mold charges are said to be possible by cutting the compound to length. The free-flowing characteristics of Glaskyd prevent distortion of the small silver-plated inserts of the relays, it is claimed, and flash is easily removed without scratching the silver.

Ingredients for urethane foams

A catalyst, said to be many times more active than fast amine catalysts commonly used for the manufacture of polyether urethane foams, has been introduced by Union Carbide Chemicals Co., Div. of Union Carbide Corp. Designated Niax Catalyst D-22, the new product is a special grade of dibutyl tin dilaurate. The great activity of this catalyst has contributed towards the development of "one-shot" polyether foams; previous techniques involved a two-step operation, using a prepolymer. The new catalyst is available in 55-gal. drum quantities at $2.05/lb. f.o.b. S. Charleston, W. Va.

Polyol polyether: Union Carbide Chemicals Co. has also developed a new polyol polyether, designated Niax triol LK-380. This polypropylene glycol polyether is used in the preparation of rigid urethane foams, and is said to offer improved aging characteristics, reduced water sensitivity, and favorable economics over polyesters which have been used for this application. According to the company, the new triol might also find use in urethane coatings and adhesives. LK-380 costs 34¢/lb. in tank car lots, f.o.b. nearest rail carrier delivery point.

"Deodorant:" The correction of odors present in many fresh urethane foams can be achieved, it is claimed, with a series of products created by Rhodia, Inc., New York 22, N. Y. Among the products are Alamask RLT 482, 483, and 28. These materials are generally employed at concentrations of 0.03% or less and are added directly prior to the addition of the catalyst.

Hercules buys Young

Hercules Powder Co. purchased Young Development Laboratories, Rocky Hill, N. J., a manufacturer of filament wound, fibrous glass-reinforced plastic materials.

Although the two companies have been working cooperatively on rocket motors for solid propellants for 10 years, Hercules' interest in Young is not confined to rocket engine applications alone.

Young's processes for reinforced plastics materials are said to hold promise in the manufacture of aircraft, automobiles components, boats, containers, tubes, furniture, and structural materials.

The facilities at Rocky Hill will be operated as the Young Development Div. of Hercules Explosives Dept., with Richard E. Young, formerly pres. of Young, remaining as director of the new division.

Polyethylene tape coating

A 1616-mile pipe line running from Baton Rouge, La., to Miami, Fla., is being wrapped with polyethylene tape coating manufactured by The Kendall Co., Chicago, Ill. The $3 million contract for the company's polyken tape is thought to be the largest single order for a protective pipe coating of any kind. The economies realized stem from major savings in manpower and equipment, since material handling and preparation are minimized. A combined cleaning and wrapping machine is used on the pipe, (*To page 184*)

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(*From page 182*)

which varies from 18 to 24-in. in diameter. Cold applied polyken tape coating does not require a primer, nor does it necessitate any drying or cooling time.

FCC warns heater operators

A determined enforcement program has been launched by the Federal Communications Commission to require operators of RF electronic heaters to bring their equipment into compliance to eliminate interference-causing radiation. Recently the Commission issued cease and desist orders to three plastics manufacturers in New York City who failed to correct radio interference and have their equipment certified as complying with FCC rules.

Corrective measures may require construction of a shielded enclosure to house the heaters, and adequate power line filtering. The Society of the Plastics Industry, Inc. has formed an RF Interference Committee, and will assist plastics manufacturers to make certain of compliance with the Commission's rules. Violation of the rules may result in civil and criminal penalties.

Part 18 of the FCC rules governing these appliances are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., price 10¢ per copy.

Mold design service

Product and mold design for precision moldings is offered by a new company, G-W Plastic Engineers, Inc., Bethel, Vt. The company specializes in close tolerance work such as intricate coring and internal threads, and is currently molding Kel-F using 0.010-in. diameter gates.

In addition to design services, G-W will supervise mold construction and testing; establish production data; and set up molding plants on a consulting basis.

Enters blow molding industry

A new company, Air-Formed Products Corp., Pine St. Extension, Nashua, N. H., manufactures blow molding machines, molds and other accessories, and also undertakes contract molding. The company is introducing a heavy duty machine, said to be capable of producing items ranging in volume from 5-gal. to 2 ounces. Larger-size blow molding machines are in process of design, the company states.

The founders of Air-Formed, Harold I. Farnsworth, president, and George E. Pickering, general manager, have been active in the blow molding industry for a number of years.

Catalysts offered

Tertiary butyl hydroperoxide, used as a catalyst in emulsion polymerizations of vinyl monomers, polyesters, styrene, and methacrylates, is now being manufactured by Cadet Chemical Corp., Burt, N. Y., and nationally distributed by the Chemical Dept. of McKesson & Robbins, Inc., New York, N. Y.

Production of a broad line of chemical derivatives of the less common metals for use as catalysts in the plastics and rubber industries has been announced by Electro Metallurgical Co., Div. of Union Carbide Corp. The new product line now includes anhydrous metal chlorides and oxychlorides which are intended as intermediates for the production of other metal derivatives. These compounds are being presently used as catalytic agents in the plastics as well as the rubber industries.

Stronger phenolic laminate

A new punching grade, phenolic laminate, said to combine excellent electrical properties with impact and flexural strength more than 50% greater than that of regular NEMA grade XXXp laminates, is available from Mica Insulator Div., Minnesota Mining & Mfg. Co.

The material, designated No. 4012-42 Lamicoid, has a high quality, phenolic resin-impregnated paper base with a special reinforcing element which provides impact and flexural strength. According to the company, the laminate is readily machined and can be punched into intricate parts with conventional equipment. Applications for the new laminate include electronic terminal boards and bases for printed circuits.

Joint polyethylene venture

Formation of a new Belgian company to manufacture polyethylene has been announced. The firm, called Cobenam, S. A., will be jointly owned by Union Carbide Corp. and the Belgian firm, Société Chimique des Derives du Petrole, S. A., Petrochim, an affiliate of Société Generale, the Belgian financial and industrial group.

Plans call for the construction of a plant near Antwerp, with an initial capacity of 30 million lb. of polyethylene annually. Production is expected to start in mid-1960. Technical know-how will be provided by the Union Carbide organization.

Multi-purpose housewares

A new line of household food storage and service items, designed by Russel Wright, and known as Refrigerator-to-Tableware, is molded by Idealware, Inc., an affiliate of Ideal Toy Corp.

The dishes are made of Fortiflex linear polyethylene, produced by Celanese Corp. of America, and possess the physical properties required for food preparation and storage, but have the styling that permits them to double as tableware.

Included in the line are salad, dessert, beverage and save-and-serve sets, pitchers, tumblers, and a butter dish. Six colors are available, and retail prices range from $1.00 for a set of six 4-oz. tumblers, to $4.00 for the salad set.

Seeks uses for new chemical

A total of $10,000 in prizes, with a first prize of $5000, is offered by The Quaker Oats Co. in a contest to find the most significant and apt commercial use for its newly developed levulinic acid (CH_3-$COCH_2CH_2COOH$). The principal potential of this product thus far seems to be that of a chemical intermediate. (*To page 186*)

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(From page 184)

Entries must be the work of a single person, are to be typewritten, double spaced on one side of white paper, and must be postmarked on or before March 1, 1959. They should be sent to "Big Idea Contest," P. O. Box 999, Evanston, Ill., to be received before March 7, 1959.

Produces amides

Commercial quantities of amides, used in plastics films as anti-block agents and lubricating additives, are now available from Archer-Daniels-Midland Co., Minneapolis, Minn. Tradenamed Adogen, these chemicals are also used to improve the penetration, flexibility, and translucency of wet-waxed paper coatings, and to provide better adhesion of printing inks.

Pearling agent

A synthetic pearling agent for incorporation before extruding or molding PVC, cellulose acetate, and polyethylene has been introduced by Rhodia, Inc., New York, N. Y. Designated Perlex 100, the compound is said to be stabilized against light exposure and to be non-toxic.

In addition to producing a pearlescent effect in plastics, it may also be used in surface coatings.

Foam with a difference

Foamed unsaturated polyester, developed by Vanguard Products, Newark, N. J., is an entirely new type of rigid foam which shows promise for such volume applications as sandwich building panels, insulation, shock cushioning, and similar applications.

The new product, called Estafoam, combines the good compressive strength and adhesion of urethane foam, with the price advantage of polystyrene foam. However, unsaturated polyester foam has processing characteristics and properties which are quite distinct from other rigid foams.

Vanguard's process consists of mechanically blending 100% unsaturated polyester resin and gas or air, *(To page 188)*

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on foaming equipment used in the production of latex and vinyl foam. After release through a nozzle, the fully expanded catalyzed foam has the appearance of whipped cream, and is deposited in a mold or on a conveyor. After a short curing period—about 8 or 9 min. at room temperature—the foam solidifies. Unlike urethane, it is poured, not foamed-in-place, thus making it easier to control density, distribution of reinforcements, and other properties. HET acid polyesters can be incorporated to produce fire-resistant foam. The lowest commercial grade density is about 2 lb./cu. ft., and costs about 8½¢ per board foot.

Vanguard Products supplies suitably modified resins, and offers technical service to its customers.

Dyeing service

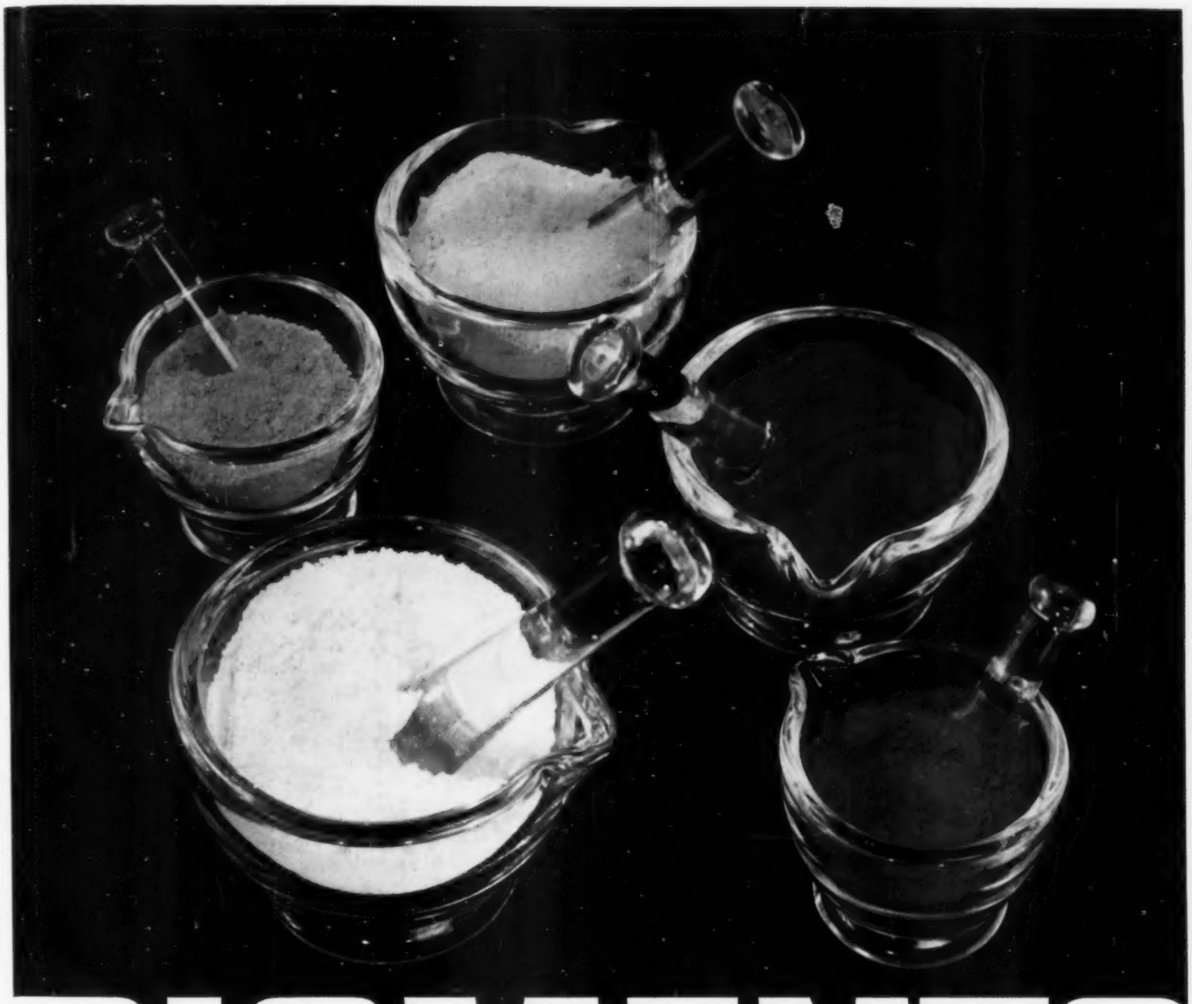
Plastics parts can now be dyed in any color and in quantities from "one part to a million" by Colorite Industrial Dyers, 244 W. 38th St., New York 18, N. Y. The company announces that it has successfully dyed nylon, Kralastic, polystyrene blends, polyesters, Lexan polycarbonate, Delrin acetal and polypropylene parts. Dyeing of the plastics parts, Colorite reports, does not affect tolerances.

Nylon propellers

Large nylon marine propellers for tugboats and trawlers are being molded by Auburn Plastics, Inc., Auburn, N. Y., for Columbian Bronze Corp., Freeport, L. I., N. Y. The extrusion molding process by which the propellers are formed is sublicensed to Auburn by Foster Grant Co., Inc., exclusive licensees in the United States for Dansk Thermoplastic Industries, Denmark, originators of this process. Foster Grant also manufactures the nylon-6 material used in this application.

Accelerator offered

Availability of commercial quantities of a technical grade of N,N-dimethyl-p-toluidine for accelerating the cure *(To page 190)*



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(From page 188)

of polyester and styrene resins has been announced by Wallace A. Erickson & Co., Chicago, Ill. Designated Accelerator DMT, the compound is priced at $1.55/lb. in drum quantities.

The amount of the chemical required will vary from 0.001 to 0.1%, depending upon the desired rapidity of cure, the company states. Most general purpose polyester and styrene resins will gel in approximately 1 min. at room temperature with the use of 0.1% of DMT, and 1% benzoyl peroxide.

Plastic lifeboats approved

All ships carrying the American flag can now use plastic lifeboats with design approved by the U. S. Coast Guard. Fibrous-glass reinforced lifeboats manufactured by two companies have recently received such approval. They are Welin Davit & Boat Div., Continental Copper & Steel Industries, Inc., Perth Amboy, N. J., and Lane Lifeboat & Davit Corp., Brooklyn, N. Y.

The hull and other structural plastics parts of the lifeboat are made of glass reinforced Hetron 92 polyester resin, produced by the Durez Plastic Div., Hooker Chemical Corp., North Tonawanda, N. Y. This resin was selected because it is inherently fire-resistant. Hetron is used as the gel coat. Enough plastic foam—polystyrene beads expanded to about 2-lb./cu. ft. density in a fire-resistant polyester shell—was installed to make the lifeboat unsinkable, even when fully loaded and completely filled with water. If the boat were cut in two, each half would still have adequate buoyancy to remain afloat, acting as a life raft, it is reported.

The keel is fibrous glass reinforced Hetron polyester, as are the thwart knees which are special premolded units. Lifelines are nylon.

New custom molder

Latest entrant into the custom molding field is Custom Engineered Plastics Co., to be known as Cepco Plastics, *(To page 192)*

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(From page 190)

St. Louis, Mo. The company has bought new injection presses and molding equipment; it will also offer designing and engineering services. R. A. Karasek, previously with General Electric's Decatur, Ill. plastics plant, is president. Frederick Taussig, president of Arundale Manufacturers, Inc., a screen manufacturing firm, and Forrest von Brecht, president of Quick Part, Inc., a metal stamping plant—both in Crestwood, Mo. —are also officers of the new company.

Enters sheet forming field

A new corporation, Hopple Plastics, Inc., 800 E. Ross Ave., St. Bernard, Cincinnati 17, Ohio, has been established to manufacture various types of vacuum formed plastics products, with emphasis on the packaging field. Hopple will specialize in blister packaging, but will also produce food trays and heavier plastics parts for industrial and household applications.

The new company is connected with The Cin-Made Corp., 5160 Kieley Pl., Cincinnati, manufacturer of fibre cans, tubes, and other cylindrical paper specialties.

Opens office as consultant

Robert S. First, formerly manager of marketing research for Atlas Powder Co., and for the Plastics Div. of Celanese Corp. of America, opened an office as industrial consultant at 6 E. 39th St., New York 16, N. Y. He will specialize in studies on diversification and expansion; distribution; and marketing for the plastics, chemical, pharmaceutical, and rare metals industries.

Makes cellulose acetate sheet

Clear transparent cellulose acetate sheet is now being manufactured by Freeport Plastic Sheet Corp., Maple Pl., Freeport, L. I., N. Y., extruders of thermoplastics. It is available in thicknesses of 0.005-in. and up, in sheets and rolls.

Called Formula 88, the material is said to be suitable for uses (To page 194)

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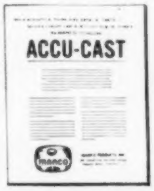

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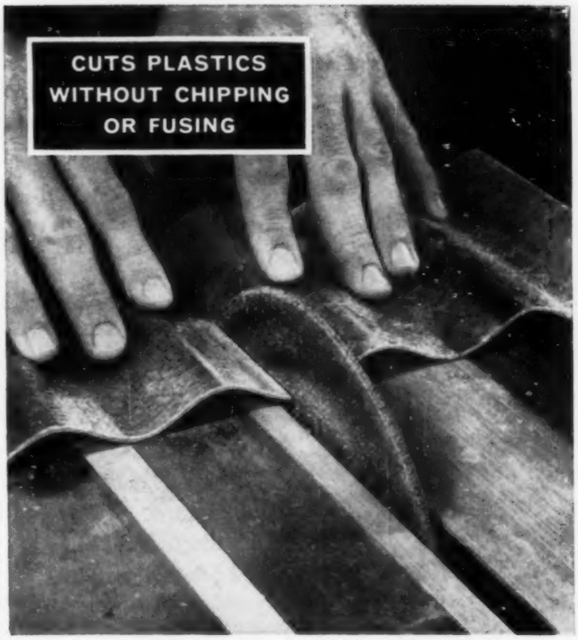

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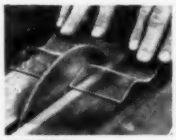
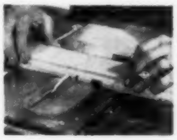


SAFE!
No teeth to snag or pull. No kickback . . . will not throw work.



VERSATILE!
Cuts and sands plastics, wood, compositions, laminates in one operation. Available in various grit sizes for different applications.

SKIL

Famous SKIL and SKILSAW products made only by SKIL Corporation, 5033 Elston Avenue Chicago 30, Illinois

THE PLASTISCOPE

(From page 192)

where clarity, dimensional stability and extended shelf life are required. Applications include boxes, sheet protectors, envelopes, etc.

Plant designed for production of polyethylene film

A new $500,000, 42,000-sq. ft. plant, with two of its three stories buried below ground for the most efficient production of polyethylene film, was opened by Chippewa Plastics, Inc., Chippewa Falls, Wis. Film produced in the new facility will be used for garment bags and other packaging and wrapping applications, including fertilizers, chemicals, seed corn and other products.

At the plant polyethylene resin granules are unloaded from railroad tank cars by an air conveyor system into 50,000-lb. capacity storage silos on the building's ground floor.

From the silos, the raw material drops by gravity into 600-lb. capacity hopper trucks on the floor below. These are then wheeled over loading chutes to load batteries of extruding machines on the lowermost level.

Film produced by these machines then flows vertically upward to finishing machines on the ground floor, adjacent to packing and shipping areas.

The new facilities will give Chippewa Plastics a productive capacity of more than one million lb. per month in the new plant, according to Donald R. Williams, president. The firm's total sales have grown from $6,264 in 1949 to $3,741,107 for the year ending June 30, 1958. Employment has increased from an original crew of four to 137. Space in the company's old plant will be used for an expansion of its research and development facilities and a smaller production plant will also continue operation.

New manufacturers' organization

Formation of a non-profit trade organization, to be known as the "National Institute of Jig and Fixture Component Manufacturers," has been (To page 197)

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announced. Companies participating in the new association include the principal manufacturers in the field.

At the organizing meeting, the following officers were elected: Erick W. Bergmann, Monroe Engineering Products, Inc., President; John Burke, West Point Mfg. Co., Vice-president.

All inquiries should be directed to Harold Wrigley, Secretary-Treasurer, at Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46, Calif. The next semi-annual meeting is scheduled for April 20, 1959, in Detroit, Mich.

Sales training scheme

A series of product discussions has been instituted by Commercial Plastics & Supply Corp., New York, N. Y., to provide its sales and office staffs with first-hand, up-to-the-minute information on the plastics materials and products warehoused and sold by the firm.

Cleveland E. Dodge, Jr., president of Dodge Fibers Corp., Hoosick Falls, N. Y., started the series off with a discussion of his company's Fluorglas yarn, woven fabric, and continuously coated fabric in sheets and tapes. This product is said to combine the best properties of Teflon and fibrous glass yarn, and has an application potential in the packaging, electronic, and electrical industries.

Reinforced plastics

Resin withstands 500°F. Commercial production of a new resin, said to be the highest heat-resistant polyester material yet developed, has been announced by the Naugatuck Chemical Div., United States Rubber Co., Naugatuck, Conn.

Designated Vibrin 136A, the new material is said to withstand a sustained temperature of 500°F., and a peak load of 1000°F. for short periods of time. According to the company, the radar transmission of the new resin is approximately 10 times better than that of conven- (*To page 198*)

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tional polyesters, and it is already in limited use as a radome material in jet bombing planes.

New resin. Laminac 4106, a new polyester resin, is now available from American Cyanamid Co. It is rigid in type, with medium reactivity, and low thixotropic viscosity.

The new resin is similar in many respects to other Cyanamid polyester resins, and can be used in dual-spray methods, including the Rand Fiber-Resin Depositor. Cure is rapid, permitting the manufacturer to produce multiple parts per day from a single mold, Cyanamid states.

Roving in tape form. Rolls of woven roving 6 and 9 in. wide are now available from Bean Fiber Glass Div., D. D. Bean & Sons Co., Jaffrey, N. H. The material is 24½ oz., style No. 4, and is supplied with four 6, and two 9 in. rolls per package.

Quartz thread. Continuous monofilaments made from pure quartz, twisted into thread, and woven into cloth on textile equipment, may be used to reinforce plastics, according to the Lamp Glass Dept., General Electric Co., Cleveland, Ohio. Quartz thread greatly improves strength-to-weight ratios and increases the potential pay-load of space vehicles, the company states. The monofilaments are approximately 0.0005 in. in diameter and when twisted into quartz thread and woven into fabric, they are said to have the basic properties of glass fabrics, the very high temperature resistance of quartz, and good tensile strength at elevated temperatures. Fused quartz is exposed in industrial use to continuous temperatures of around 1800° F., and for short periods of 3000° F.

Because of the chemical inertness of quartz, its resistance to weathering is good. However, the same property limits the possibility of dyeing or staining quartz cloth. And while the properties of quartz make it of great value in heat-resistant plastics structural forms, they cause difficulties in manufacture that result in a price many times that of ordinary fiber, the company points out.

In rocket and missile applications, however, the high price is moderated by the fact that as replacement for metal, quartz-reinforced plastics may effect a weight reduction of more than 10 to 1.

Parallel fiber material. Production of a new pre-impregnated parallel glass fiber material has been announced by The Houze Glass Corp., Point Marion, Pa. Called Houze Hi Mod, the material is said to have flexural strengths up to 274,000 p.s.i. and moduli up to 10.4 million p.s.i.

The company's process involves the application of a "B" stage resin at the fiber furnace, thereby encapsulating each individual fiber and preserving its inherent strength. Because of the uniform distribution of fibers and resin and a special neutral surface glass, the company claims extremely high burst strengths and hoop stress in tubular forms, which are of advantage in pressure vessels.

Hi Mod is available in mat form and in tape widths for tube winding applications. It is nationally distributed by Materials & Processes, Inc., Shoreham Bldg., Washington 5, D. C.

Molding compound. A new flame-retardant fibrous glass-reinforced compound is being used by The Glastic Corp., Cleveland, Ohio, for the molding of electrical insulating parts. Designated Glastic Grade UMG 1500, it is recognized by Underwriters' Laboratories as acceptable for sole support of current-carrying parts at temperatures ranging up to 150° C.

Parts molded from the new compound are said to be substantially lower in cost than those molded from phenolic of comparable impact strength.

The new compound is not presently available to other manufacturers.

Resin for sheet. A methyl methacrylate modified resin intended for reinforced plastics parts, par-

ticularly corrugated and flat sheet, is available from Amcel Co., Inc., New York, N. Y. Designated MX409, the resin is said to exhibit good resistance to discoloration, surface degradation, and loss of translucency.

Lower cost premix. A new glass reinforced polyester molding compound called Thermaflow 105, and said to be suitable for most structural applications, has been developed by Atlas Powder Co., Wilmington, Del. According to the company, the material is at least 20% lower in cost than similar quality molding compounds. It is claimed to provide good surface smoothness and gloss and exceptionally uniform strength throughout the molded part.

Thermaflow 105 has good resistance to concentrated alkali, dilute acids, and organic solvents, Atlas states. It has a heat distortion point above 450° F. and is said to have electrical properties comparable to most high quality molding compounds.

Polarizing panel. A fibrous glass-reinforced polarizing light panel which produces a high-efficiency, glare-free illumination, has been introduced by Owens-Corning Fiberglas Corp.

The panel employs reflected and refracted polarization to achieve brightness control and uniform light distribution, which permits a high level of illumination with reflected glare controlled in the single panel.

The new polarizing material is produced in flat sheets up to 24 by 48 in., and consists of color-stable resin reinforced with Fiberglas flakes.

New custom molder. The Cimastra Div. of The Cincinnati Milling Machine Co. has developed its own process for custom molding reinforced plastics.

Using pigmented fibres and molding them with resins of the same or contrasting shades, the company can make high-styled products in tune with modern color trends. Varied cross sectional thickness can be specified, and sharp radii, flanges and intricate shapes can be produced because the (*To page 200*)

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critical resin-reinforcement ratio will be maintained for needed strength, according to an announcement by the company.

Expansion

Urethane Corp. of America moved from Buffalo, N. Y., to a larger factory at 410 East Center St., Medina, N. Y. The new facilities provide about five times as much manufacturing space for molded flexible and rigid urethane foam products as the old plant, and also include a laboratory, and office space.

Monsanto Chemical Co. has completed a 25% expansion of production capacity for phthalate esters at its Everett, Mass. plant. Capacity is now three times that of the original unit constructed in 1953. This coincides with a growth in plasticizer production in the U. S. from 292 million lb. in 1953 to an estimated 460 million lb. in 1958. Monsanto markets more than 70 different plasticizers. The large majority of these are phthalate esters.

Koppers Co., Inc. plans construction of a new research center on a 176-acre tract at Monroeville, Pa. Site development and initial construction of an administration building, three chemical laboratories, a power plant and supporting facilities are programmed to begin this year. Research involving pilot plants will remain at the Verona, Pa., research center for the immediate future.

Reichhold Chemicals, Inc. has increased capacity at its plant at Ballardvale, Mass., to produce 10 million lb. of acrylic emulsion a year, including products for the surface coating and leather finishing industries.

Reichhold Chemicals (Canada) Ltd. began construction of a sizable phenol plant and formaldehyde unit at the company's Port Moody, B. C., location, as well as the building of another phthalic anhydride plant at St. Terese, Quebec. *(To page 202)*

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Cadillac Plastic & Chemical Co. completed a new regional distribution center at 313 Corey Way, South San Francisco, Calif., which reportedly more than doubles the company's previous facilities in that city.

Reynolds Chemical Products Co., Div. of **Stubnitz Greene Corp.,** has consolidated the operations formerly conducted in Ann Arbor and Ypsilanti, Mich., in a new 60,000 sq. ft. plant in Whitmore Lake, Mich. The new facilities will be used for production of plastisol coatings and urethane foams, and will also house sales and executive offices.

International Molded Plastics, Inc., Structoglas Div., has completed a new 35,000 sq. ft. factory in Grand Junction, Tenn. The plant will be used for the manufacture of corrugated and flat fibrous glass panels, using a process developed by International engineers. **Richard L. Dreher** has been named plant manager for the new factory.

Algemene Kunstzijde Unie (A.K.U.), Arnhem, Holland, and **British Industrial Plastics, Ltd.** are negotiating to set up a joint company in the Netherlands for the manufacture of urea formaldehyde and melamine formaldehyde molding powder and resins to supply the European Common Market.

Borden Chemical Co. has dedicated a $4 million addition to its PVC plant in Leominster, Mass. The company's polyvinyl chloride production capacity at this plant has now been increased from 12 to 38 million lb. per year. The size of the development laboratories at this site has also been doubled at a cost of $500,000, according to the company.

Deceased

Barthold E. Schlesinger, 82, a pioneer in the plastics molding industry, founder and former treasurer of **Northern Industrial Chemical Co.,** Boston, Mass., died on Dec. 15, 1958. *(To page 204)*

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Israel Dennis, president of **Dennis Chemical Co.,** St. Louis Mo., died on December 15, 1958.

Donald G. Rogers, 66, former president of **Allied Chemical's National Aniline Div.,** died on December 30, 1958.

James W. Wilcox, 62, executive vice president and treasurer of **Columbus Coated Fabrics Corp.,** Columbus, Ohio, died January 4, 1959, following a heart attack. He joined the company in 1919 and was elected vice president and treasurer in 1952.

Meetings

Plastics groups

February 5, 12, and 19: Society of Plastics Engineers, Inc., North Texas Section, Room 100 E, Engineering Bldg., Arlington State College, Arlington, Texas. Seminar will be devoted to the basic plastics materials.

March 4: Society of Plastics Engineers, Inc., Western New England Section, Bradley Field, Terrace Dining Room, Windsor Locks, Conn. Panel Discussion: "The Needs of Our Customers in New England."

March 26, 27: The Society of the Plastics Industry, Inc., 16th Pacific Coast Section Conference, Hotel Del Coronado, Coronado, Calif.

June 17-27: International Plastics Exhibition & Convention (formerly British Plastics Exhibition & Convention), Olympia, London, England.

October 17-25: "Kunststoffe 1959," International Fair of the Plastics Industry, Duesseldorf, West Germany.

Other meetings

February 23-26: Technical Association of the Pulp and Paper Industry, 44th TAPPI Annual Meeting, Hotel Commodore, New York, N. Y.

March 26: American Society for Quality Control, Rochester Section. Fifteenth Annual Quality Control Clinic, University of Rochester, Rochester, N. Y.—END

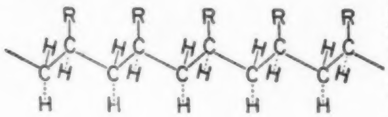
HERE'S THE STORY ABOUT *Moplen** POLYPROPYLENE: New polymer of isotactic structure offers high softening point . . . excellent mechanical, thermal and electrical properties . . . easy processing.

CHEMICAL NATURE & STRUCTURE

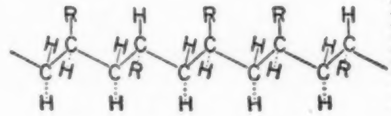
"MOPLEN" is the trademark of the polypropylene produced by Montecatini Soc. Gen. by stereospecific polymerization of propylene, an asymmetric olefin available in large amounts from both the petroleum and petro-chemical industries.

When propylene molecules join each other during polymerization, the resulting polymeric chains may, depending on the polymerization conditions, assume one or the other of the structures shown in the illustrations. Here (supposing the polymeric chain stretched on a plane) the dotted lines indicate bonds with atoms or groups lying below the plane, and the continuous lines indicate bonds with atoms or groups lying above the plane.

I. ISOTACTIC



II. ATACTIC



Using stereospecific catalysts discovered by Professor Giulio Natta of the Milan Polytechnic Institute, a structure (I) can be obtained which corresponds to the highest intramolecular order, and which is called "isotactic," that is, spatially ordered.

On the other hand, when chain formation occurs at random, the final product has a disordered structure, which is called "atactic" (II). In other words, depending on polymerization conditions, different macromolecular structures and therefore different characteristics of the polymer may be obtained. These can be adapted to different technological purposes.

"MOPLEN"

Montecatini now produces in Italy the following types of "MOPLEN": M1, M2 and A2.

M 1 has a melt index of about 20, remarkable fluidity in the melted state, and is therefore particularly suitable for extruded films and blown moldings.

M 2 has a melt index of about 6, and is suitable for injection molding and the extrusions of pipes and shapes.

A 2 has a melt index of about 4, and is suitable for injection molding and extrusion. It is stiffer, harder, has higher resistance to heat than M 1 and is especially good for electrical applications.

It is expected that in the near future Montecatini will be able to offer other types of "MOPLEN." Their different molecular weights and technological characteristics will enable them to fulfill the widest possible requirements of the market.

For more detailed information about "MOPLEN" please write, outlining area of interest, to

Chemore Corporation
General Representative in U.S.A. & Canada for Montecatini
21 West Street, New York 6, N. Y.

Typical physical properties of MOPLEN M2 and A2

PROPERTIES	TEST METHOD	UNITS	RANGE OF VALUES
PHYSICAL AND MECHANICAL			
Specific gravity	ASTM D792–50	kg/liter	0.90–0.91
Apparent density (granular form)	" D392–38	kg/liter	0.40
Bulk factor	" D1182–54	—	2.25
Yield strength	" D638–52T	kg/cm² lbs/in²	300–350 4,300–5,000
Ultimate tensile strength (.2"/min.)	" D638–52T	kg/cm² lbs/in²	300–380 4,300–5,400
Elongation (yield point)	" D638–52T	%	10–20
Total elongation	" D638–52T	%	500–700
Compressive strength	" D695–54	kg/cm² lbs/in²	600–700 8,500–10,000
Stiffness (flexural)	" D747–50	kg/cm² lbs/in²	8,500–13,000 120,000–186,000
Hardness, Rockwell	" D785–51	R-scale	85–105
Impact strength, Izod test, ½" x ½" unnotched bar	" D256–54T	kg/cm/cm² ft. lb/in	80 19
Young's modulus	ultrasonic	dyn./cm²	$3.0–3.6 \times 10^{10}$
Water absorption	ASTM D570–54T	% weight increase	nil
ELECTRICAL			
Dielectric constant (10^6 cycles/sec.)	ASTM D150–54T	—	2.0–2.1
Dissipation factor (10^6 cycles/sec.)	" D150–54T	—	.0002–.0003
Dielectric strength	" D149–55T	kV/mm V/mil	30–32 750–800
Volume resistivity	" D257–54T	Ohm • cm	10^{16}
THERMAL			
Melt index†	ASTM D1238–52T	g/10 min.	4–6
Thermal conductivity	—	cal/cm/cm²/sec./°C B.T.U./in/ft²/hr/°F	2.1×10^{-4} .73
Specific heat	—	K cal/g./°C	0.46
Coefficient of thermal expansion	ASTM D696–44	cm/cm/°C in/in/°F	110×10^{-6} 61×10^{-6}
Deformation under load‡	—	%	<10 at 135°C
Softening point (Vicat–1 kg.)	DIN 57302	°C °F	>140 >284
" " (Vicat–5 kg.)	" "	°C °F	>85 >185
1st order transition temperature	crystallographic microscope	°C °F	164–170 329–338
2nd order transition temperature	specific volume test	°C °F	–35 –31
Resistance to heat when not subject to strain	—	°C °F	150 302

† Method modified by using 10 Kg. load instead of 2.16 Kg.
‡ Under tension of 15 Kg/cm² (210 lbs/in²) by increasing temperature at the rate of 50°C/hr. (90°F/hr.)

*Montecatini Trademark

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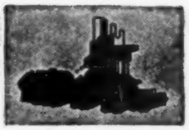
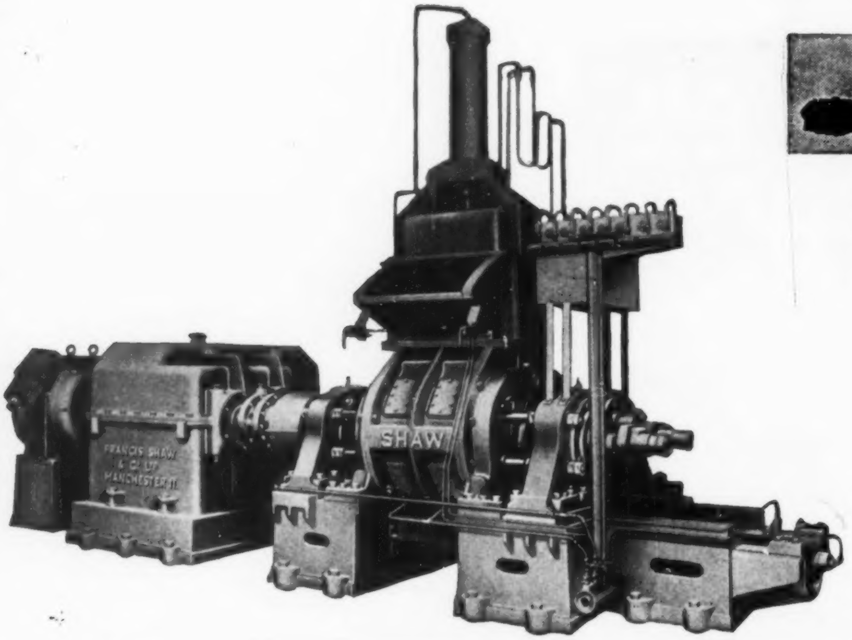


INTERMIX. A robust high efficiency Heavy Duty Internal Mixer for mixing plastic compounds at lower-than-normal temperatures. It is supplied with steam heating for plastics and other materials, and the exclusive rotor design ensures consistent high quality mixing.



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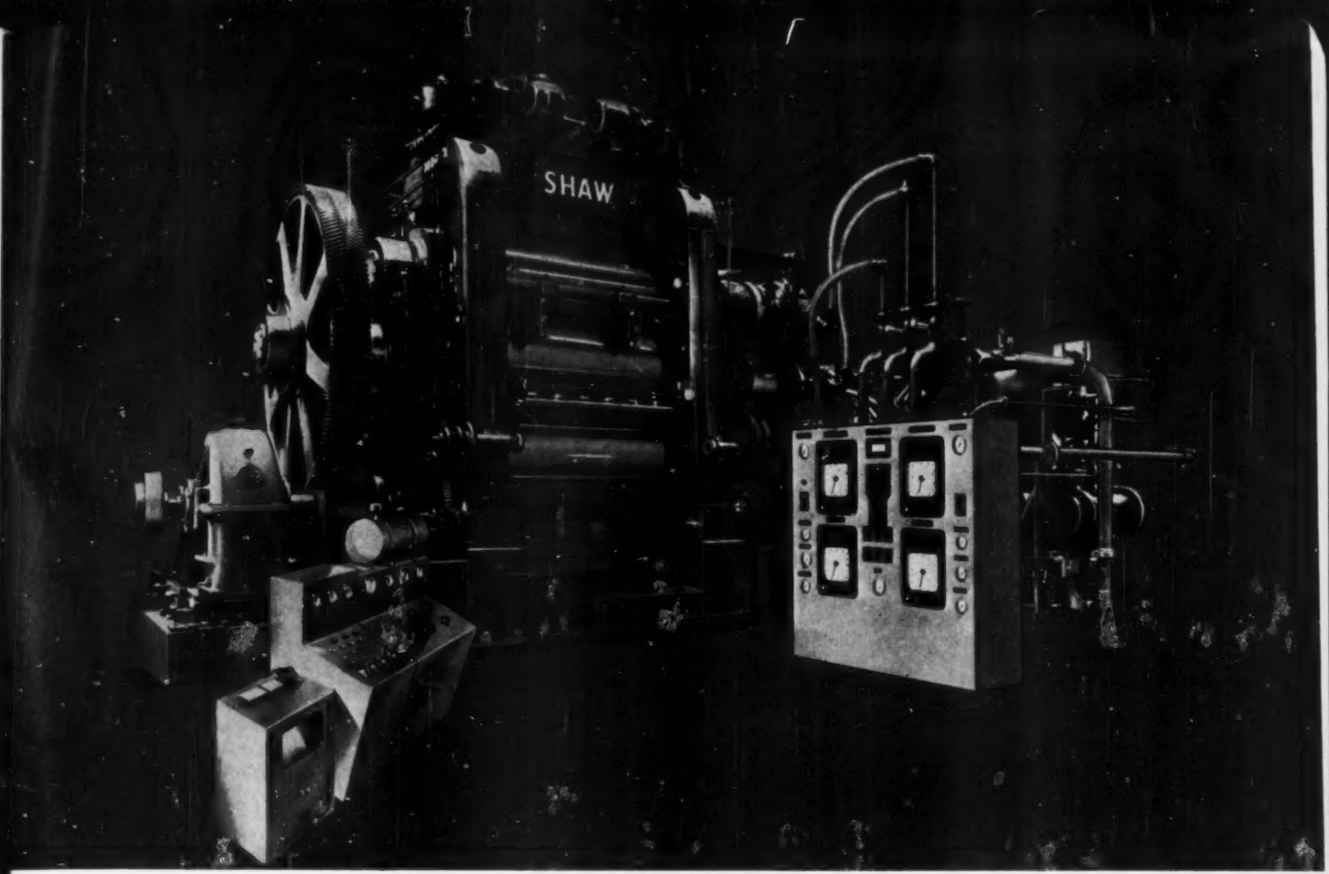
quality engineering puts efficiency into Shaw machines

The cost-cutting performance of every Francis Shaw machine and its thorough dependability are the result of long experience and unvaryingly high standards of engineering in every detail of manufacture.

Close-limit accuracy and rigorous inspection during manufacture guarantee to the user a consistently high quality output from Francis Shaw equipment.

Francis Shaw are available for the design, manufacture, and installation of a wide range of processing equipment


SHAW


SHAW

COMPANIES . . . PEOPLE

Appointments, promotions, and relocations in the plastics industry.

The Dow Chemical Co.: Dr. E. O. Barstow retired as dir. and as VP, but was named to newly created post of hon. chrmn. of the board. **R. L. Curtis** also retired as dir. and gen. mgr. of the company's Western Div. He remains a VP and sr. officer on the West Coast. **Leland A. Doan** replaces Mr. Curtis as gen. mgr.

Donald K. Ballman, dir. of sales, and **C. B. Branch,** mgr.—plastics dept., named dirs.

The company opened a sales office at 504 Wachovia Bank Bldg., Charlotte, N. C. **T. H. Caldwell, Jr.,** named mgr.

The Shakespeare Co., Kalamazoo, Mich., mfr. of fibrous glass rods and tubes, purchased all the assets of **Parallel Plastics, Inc.,** Waverly, Ohio. The new corporation will be known as **Parallel Products Co.,** and will continue to manufacture Parabow archery equipment at Waverly.

Leonard S. Meyer, former pres. of Parallel, is a VP of the company. **George A. Shira** will continue to supervise production. **Henry Shakespeare** is chrmn. of the board, **Curtis W. Davis,** pres.; **William G. Blatz,** exec. VP; **Arthur L. Scott,** VP and gen. mgr.

The Society of the Plastics Industry, Inc., Reinforced Plastics Div.: The following officers were elected unanimously for the fiscal year June 1, 1959 through May 31, 1960: **A. W. Levenhagen, Molded Fiber Glass Tray Co.**—gen. chrmn.;—**L. Stievator, Jr., McKesson & Robbins, Inc.; Harry R. Sheppard, Westinghouse Electric Corp.,** and **Frank X. Ambrose, Alsynite Co. of America**—Eastern, Midwestern and Western chrmn., respectively.

John Avignone, M. A. Cuming & Co., Inc.; Wm. G. Cole, Jr., Ferro Corp.; and **Arthur J. Wiltshire, Apex Reinforced Plastics Div., White Sewing Machine Corp.,** elected members of the Exec. Committee.

Eastman Kodak Co.—Tennessee Eastman Co.: Harry D. McNeeley promoted from VP to exec. VP. He has also been named VP of **Eastman Chemical Products, Inc., Holston Defense Corp., and Holston Trading Corp.,**—all Kodak subsidiaries located in Kingsport, Tenn., and VP of **Texas Eastman Co.** div., Longview, Texas.

Eastman Chemical Products, Inc.: William P. Gideon III heads the newly formed plastics sales development group, and will correlate the work of the Tenite development laboratory with the needs of industry. **Roy O. Hill, Jr.** is in charge of the newly formed techn. information section, which deals with literature on the Tenite plastics, and serves as a clearing-house for special techn. reports. Both sections are headquartered at Kingsport, Tenn.

G. S. Equipment Co., Cleveland, Ohio: **Carel H. Neffenger** named gen. sales mgr. **Robert F. Pyle** and **George D. Stevenson** appointed dist. sales mgrs. All three will hold the same positions in the affiliated companies—**General Supply Co.** and **G. S. Plastics Co. Arthur W. Reckling** named a dist. sales mgr. for G. S. Equipment and G. S. Plastics.

Shell Chemical Corp. formed four additional fully-integrated divs., including a plastics and resins div.

Martin Buck, formerly asst. to the pres., heads the new plastics and resin div., which will also direct the operation of an appropriate portion of the Houston, Texas, plant.

Allied Chemical Corp.—Plastics & Coal Chemicals Div.: Frank M. Norton, previously VP, Semet-Solvay Div., named VP—engineering, manufacturing, purchasing.

Semet-Solvay Div.: Harold E. Imes promoted from dir. of operations to VP, succeeding Mr. Norton. **Ralph H. Ratliff** succeeds Mr. Imes.

Solvay Process Div.: Lester B. Gordon retired as VP and is succeeded by **Arthur Phillips, Jr.**

Monsanto Chemical Co., Plastics Div.: H. W. Mohrman, formerly dir. of research, appointed to newly created post of dir. of research—associated interests. He is succeeded by **Dr. R. J. Schatz.**

Peter J. Grey joined the research dept. at Springfield, Mass.

Union Carbide Corp., Union Carbide Chemicals Co.: Norman R. Cox, Dr. Robert G. Kelso, and **Dr. Fred W. Stone** appointed group leaders in the Development Dept., S. Charleston, W. Va. **Dr. John R. Nazy** and **Ronald A. Thursack** joined the dept.

The Appleton Machine Co., Appleton, Wis.: **Victor W. Bloomer** promoted from pres. to chrmn. of the board; **Tany Agronin,** formerly exec. VP and gen. mgr., now pres.; **John M. MacDonald, Jr.** named VP. The company manufactures slitters and other plastics processing equipment.

Du Pont—Polychemicals Dept.: Dr. Russell B. Akin, formerly product mgr.—Lucite acrylic resins, named asst. dir. of the sales service laboratory. He is succeeded by **Orrin G. Youngquist. Frank L. Brevoort, Jr.,** formerly asst. laboratory dir., succeeds Mr. Youngquist as Chicago, Ill., dist. sales mgr. for Teflon resin.

Film Dept.: Robert R. Smith, formerly asst. dir. of sales, becomes dir. of a new Packaging Sales Div., and **Robert C. Myers,** previously mgr. of packaging sales, is now dir. of a new Industrial Sales Div.

Howell D. Chickering succeeds Mr. Myers and **J. B. Phillips, Jr.** replaces Mr. Chickering as mgr., eastern dist. packaging sales, with headquarters in Philadelphia. **W. F. Good** takes over from Mr. Phillips as asst. mgr., N. Y. dist. packaging sales.

Jake T. Nolen appointed mgr. of sales programs for Mylar polyester film, and **J. Thomas Axon** named to the same position for polyethylene film.

General Electric Co., Chemical Materials Dept.: Dr. George E. McCullough named polycarbonate mfg. mgr., **Dr. Leroy S. Moody** appointed polycarbonate engineering mgr.

Chemical & Metallurgical Div. formed a new products dept. known as the Insulating Materials Dept. It will have headquarters in Schenectady, N. Y., and will also have responsibility for a paint mfg. plant in Chelsea, Mass., the irradiated polyethylene operations in Pittsfield, Mass., and the mica mat production equipment at Coshocton, Ohio. **Theodore C. Ohart** named gen. mgr.

The Maine Moulded Plastics Co., Boothbay Harbor, Me., is a new company engaged in production of reinforced plastics components for a nuclear guided missile carrier, under contract with the **Shipbuilding Div., Bethlehem Steel Co.** The firm also contemplates production of thermosetting plastic automobile bodies.

Earl Gaw is pres. **Clarence Jeffrey** is VP—engineering and prod. **Jay Bracey,** owner of **Boothbay Laminates,** named treas.

Ultra Plastics, Inc. moved from 2601 N. Howard St. to 28th and Parrish Sts., Philadelphia, Pa.

Food Machinery & Chemical Corp., Becco Chemical Div., created a new southeastern sales territory comprising Georgia, Alabama, Mississippi, the central part of Tennessee, and northern Florida. **Frank Nerney** named mgr.

United States Rubber Co. combined sales responsibilities for coated fabrics and foam rubber cushioning. **William J. Mulvey** named sales mgr. of the newly combined depts., responsible for sales of Koylon foam seating and Naugahyde upholstery and other coated fabrics. **Charles H.**

Baldwin appointed sales mgr.—Koylon foam seating with headquarters in the Mishawaka, Ind. plant. **John Brady** named sales mgr.—coated fabrics made in the Mishawaka plant, and **Thomas Martin** continues as sales mgr.—coated fabrics made in Stoughton, Wis. plant.

The following were named regional sales mgrs.: **Jack L. Bonnell**—West Coast; **Robert Gardner**—central region; **Joseph P. Gavin**—Midwest; **Edgar J. Artesani**—South; **Earl Kochersperger**—East.

W. R. Grace & Co.—Polymer Chemicals Div.: W. E. Maclean appointed head of the engineering and maintenance dept. at the Baton Rouge, La. polyethylene plant. He succeeds **A. J. Bruno,** who becomes special project mgr.

American Chemical Society—Paint, Plastics, and Printing Ink Chemistry Div.: Dr. Allen L. Alexander, Naval Research Laboratory, Washington, D. C., elected chrmn. **Walter A. Henson, Dow Chemical Co.,** named chrmn.-elect and **Dr. Edward G. Bobalek, Case Inst. of Techn.,** chosen vice-chrmn.

Polymer Chemistry Div.: Dr. Frank R. Mayo, Stanford Res. Inst., elected chrmn. **Prof. Charles G. Overberger, Polytechnic Inst. of Brooklyn,** is vice-chrmn.

Manufacturing Chemists' Assn., Inc. moved from 1625 Eye St. to the Universal Bldg., 1825 Connecticut Ave., N. W., Washington 9, D. C.

James F. King named asst. to the pres. in charge of govt. relations.

The Martin Co., manufacturers' rep. for **International Molded Plastics, Stomar Mfg.,** etc., moved from 200 Fifth Ave. to 230 Fifth Ave., New York, N. Y.

Charles L. Martin, founder and pres., left the company to join the sales organization of **Rubbermaid, Inc.,** mfrs. of polyethylene housewares.

Robert Janson now heads The Martin Co., **Edwin Moran** and **Marvin Wolfe** are also associated with the company.

Conopac Corp., New York, N. Y.: **E. E. Miranda,** formerly mgr.—**Roto-Wrap Div.,** elected VP. He is succeeded by **Charles F. Van Sweringen.**

Robinson Aviation, Inc., Teterboro, N. J., vibration control engineers, formed a new company, **Robinson Plastics, Inc.,** a wholly-owned subsidiary. The new company will design and distribute a complete line of plastics ware, featuring a non-spill cup, to meet the special requirements of airline and transportation use.

Carlisle Corp., Carlisle, Pa., mfr. of plastics and rubber products, acquired **Tensolite Insulated Wire Co., Inc.,** Tarrytown, N. Y., (*To page 210*)

COMPANIES . . . PEOPLE

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mfr. of high temperature, Teflon-insulated wire and cable. The wire company will function as a wholly-owned subsidiary of Carlisle, with its present officers and personnel.

Valco, Inc., 7500 Fourth St., North, St. Petersburg, Fla., is a new mfr. of decorative and industrial fibrous glass reinforced paneling. The company expects to be in production in March. **Henry Valus** is pres., **Anver S. Suleiman,** formerly with the industrial applications dept. of Monsanto Chemical Co., is VP and gen. mgr.

Cashman & Norton, Plastics Engineers, Box 124, Broomall, Pa., appointed reps. for **Sinko Mfg. & Tool Co.,** Chicago, Ill., plastics molders.

General Foam Corp.: Alfred Schoen succeeds **Willy Schwab** as pres. **Fred Buff** elected VP and **Ilse Norman** named secy. and treas. The company distributes and fabricates urethane and PVC foam, and maintains plants in New York, N. Y. and Hazelton, Pa.

The three officers will also assume the same duties in **Schwab Rubber Co., Inc.** Mr. Schwab will continue to be a dir. of both companies.

General Mills, Inc.: Gerald S. Kennedy, previously exec. VP, succeeds **Harry A. Bullis** as board chrmn. **Arthur D. Hyde** named exec. VP.

Seiberling Rubber Co., Plastics Div.: David K. Homan, 860 Second St., San Francisco, Calif., and **Lester H. Glasberg,** 20 Daniel St., Newton Center 59, Mass., appointed West Coast and New England agents respectively, for the company's line of Seilon plastics, which include polyethylene, PVC, PVAc, and polystyrene sheets.

American Can Co. consolidated the operations of its former subsidiaries, **Sun Tube Corp.,** and **Bradley Container Corp.,** with the parent company. The facilities of the former subsidiaries will be operated by a newly-formed **Bradley-Sun Div.** of American Can Co., which will continue to manufacture and sell the product lines formerly produced by Sun and Bradley.

Kenneth M. Leghorn, formerly pres. of Bradley Container Corp., named VP and gen. mgr. of the new div. **Joseph D. Martin,** previously pres. of the Sun Tube Corp., was also made a VP of the new div.

Arvin Industries, Inc., Columbus, Ind.: **Norwood & Krauss,** Detroit, Mich., and **James R. Neff,** Indianapolis, Ind., named manufacturers' reps. for Arvinyl vinyl-metal laminate in Michigan, Indiana, and Kentucky, respectively. (*To page* 212)

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Metropolitan Assn. of Film Converters, Inc., 521 Fifth Ave., New York 17, N. Y.: **Alan Spigel, Clearprint, Inc.**, elected pres. **Fred Abrams, Vizofilm Mfg. Corp.**, is VP.

The association's 1959 program includes development of trade standards and fair trade practices; exchange of techn. and market information.

Ace Plastic Molding Co., 1611 S. Laramie Ave., Chicago, Ill., is a new custom molder with 10 injection molding machines and, according to the company, Ace will produce the majority of plastics boxes sold by **Bradley Associates**, Chicago, Ill. **M. Nozette**, pres. of Bradley, is also pres. of Ace.

The Plas-Tex Corp., Los Angeles, Calif.: **Clark Housewares Sales Co.**, Cincinnati, Ohio, and **Don Rose Associates**, Detroit, Mich., will handle sales of the company's polyethylene housewares. Clark will cover Ohio, W. Pa., and W. Va., and Rose handles Mich.

American Optical Co. moved its plastics plant to the Southbridge, Mass., headquarters. The company will also install new production equipment, including a 12-16 oz. injection molding machine for plastics lenses.

Micro Craft, Inc., 319 S. Anderson St., Tullahoma, Tenn., is a new company specializing in building lightweight reinforced plastics models of missiles and aircraft for use in wind tunnel tests. The company also manufactures missile components, instrument encapsulation, and fibrous glass structural members for aircraft. **Charles E. Folk** is pres., **Benton Cleveland** is VP.

Hastings Plastics, Inc., Santa Monica, Calif., appointed sole West Coast distributor for Epiphen epoxy resins manufactured by **Borden Chemical Co.**

Florida B & B Distributing Co., Hialeah, Fla., and Atlanta, Ga., appointed selling agents for polyvinyl alcohol and polyvinyl chloride film manufactured by **Reynolds Metals Co.**

Mobay Chemical Co.: Sid P. Thomes and **H. N. Woebcke** named dir. and asst. dir. of engineering, respectively.

Acheson Dispersed Pigments Co. moved its main office from 1421 Chestnut St. to Suite 1111, Suburban Sta. Bldg., 1617 Pennsylvania Blvd., Philadelphia 3, Pa.

Helmac Plastics, Inc., St. Petersburg, Fla., has taken over injection molding business formerly *(To page 214)*

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MODERN PLASTICS ENCYCLOPEDIA ISSUE

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COMPANIES . . . PEOPLE

(From page 212)

known as **Helmac Plastics.** The company will also continue to represent other plastics suppliers previously represented by **Owen S. Riffle,** pres. of the new corporation.

Hedwin Corp., Baltimore, Md.: **Edward W. Smith III,** formerly eastern sales mgr. of Bradley Container Corp., appointed gen. sales mgr.

R. Hurwich Co., Berkeley, Calif., and **Ison Co.,** Atlanta, Ga., named sales reps. for the company's plastic packaging products.

A. H. Wirz, Inc., Chester, Pa.: **Daniel B. McAfee,** formerly New England dist. mgr. for American Cyanamid's Plastics & Resins Div., named VP—sales. **Robert Mahan** now VP—operations.

A. O. Smith Corp., Milwaukee, Wis., formed a reinforced plastics div. to manufacture plastics pipe and other products. **James F. Donnelly, Sr.,** formerly asst. to the exec. VP, named gen. mgr. of the div.

Hobbs Mfg. Co., Worcester, Mass.: **Howard K. Lambert** named gen. sales mgr.—machine div. **Larry Damour,** previously plant sales engineer succeeds Lambert as dist. sales mgr. in Cleveland, Ohio.

Ace Plastic Co., Jamaica, N. Y., plans to enter the heavy industrial and extrusion fields. **Richard W. Halverson** named chief extrusion engineer. **Louis Flynn** is prod. mgr.

George R. Mallory promoted from mfg. mgr. to VP of **Kimball Mfg. Corp.,** San Rafael, Calif., molders of fibrous glass products. Kimball is a subsidiary of **Bristol-Myers Co.**

Roland Lehr, pres. of **Baker Bros., Inc.,** Toledo, Ohio, plastics molding machine and machine tool builder, elected to additional post of pres. of **Gear Grinding Machine Co.,** Detroit, Mich. There will be no other changes in the management of Gear Grinding and the two companies will operate completely independently.

Leo Gans appointed asst. gen. mgr. of **Anchor Plastics Co., Inc.,** Long Island City, N. Y.

Robert B. Rockwood appointed to head the newly-formed design consulting service of **Polyplastex United, Inc.,** Union, N. J., producers of Pan-lam decorative rigid vinyl laminates.

G. F. Blinzler named western dist. mgr. in charge of Marlex sales at Pasadena, Calif. He succeeds **R. G. Askew** who was promoted to export mgr. of Phillips plastics sales div., with headquarters in New York, N. Y. *(To page 216)*

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Harry C. Wechsler appointed a VP of **Borden Chemical Co.** He will be responsible for development of various plastics projects, but will maintain his present responsibilities as gen. mgr. of the company's PVC dept., at Leominster, Mass.

William A. Angus joined **Rubber & Asbestos Corp.**, mfrs. of industrial adhesives, Bloomfield, N. J., as VP—sales, a new executive position in the company's marketing structure.

Charles H. Rybolt, formerly dir.—chemicals divs., and gen. mgr.—Lucidol Div., Buffalo, N. Y., promoted to VP—chemicals divs., **Wallace & Tiernan, Inc.**, Belleville, N. J. The chemicals divs. manufacture plasticizers, organic peroxides, sebacic acid, and fatty acids.

Frank Jones appointed dir.—market development, **Michigan Chrome & Chemical Co.**, Detroit, Mich. He will handle the company's plastisols, fluidized bed resins, and other organic coatings.

William C. Bentinck promoted from prod. mgr. to VP—prod. of **Aeromarine Plastics Corp.**, Sausalito, Calif. He has been in charge of production of the 41 ft. all-plastics sloops and yawls for the company's Bounty Div.

Sarah Lee Gerrish, formerly Midwest editor of *Printers' Ink*, has been appointed Midwest editor of *Modern Packaging*. She succeeds **Phillip A. Urion**, who resigned to become editorial dir. in the Chicago, Ill., office of Booz, Allen & Hamilton, management-consultant firm. Mrs. Gerrish will work out of *Modern Packaging's* Chicago office.

Jack H. Dollinger, formerly gen. mgr., now pres. of **Ferro Chemical Corp.**, Bedford, Ohio, a subsidiary of **Ferro Corp.**, Cleveland, Ohio.

Edward G. Atkinson, Ridgefield, Conn., named eastern sales engineer for the **Fiberite Co.**, Winona, Minn., manufacturers of plastics molding compounds. **Edward Keusch**, Bloomfield, N. J., will continue in a tech. service capacity.

Israel L. Sonenshein elected VP of **Atlantic Chemical Industries, Inc.**, Passaic, N. J., the parent company of a group of organic chemical manufacturers producing intermediates, dyestuffs, polystyrene, etc.

Dr. Howard L. Gerhart promoted from research dir. to dir.—research & development, Paint & Brush Div., **Pittsburgh Plate Glass Co.** He will direct the activities of over 500 tech. personnel engaged in research, de-

velopment, application, and tech. sales service for plastics, special coatings, industrial and automotive finishes, etc.

Dr. Robert C. Kuder, formerly supv.—polymer research, Plastics & Coal Chemicals Div., Allied Chemical Corp., and most recently tech. dir. Bemis Bros. Bag Co., joined **Mol-Rez Div., American Petrochemical Corp.,** Minneapolis, Minn., as dir.—R. & D.

Dr. George R. Mitchell, formerly chemical development mgr. of Olin Mathieson, Port Jefferson, N. Y., is now in charge of materials development engineering for **The Glastic Corp.,** Cleveland, Ohio, manufacturers of fibrous glass reinforced polyester electrical insulation.

John W. Vance named asst. sales mgr.—chemical sales of **Sinclair Chemicals, Inc.,** a subsidiary of **Sinclair Oil Corp.** He will have headquarters in New York, N. Y.

Hugh S. Sutherland, formerly exec. VP and gen. mgr. elected pres. of **Shawinigan Chemicals Ltd.,** succeeding **Dr. R. S. Jane,** who died recently.

Robert M. Aude appointed VP and gen. mgr., **Heyden Chemical Div., Heyden Newport Chemical Corp.**

George J. Godfrey appointed tech. dir. of **Reed Plastics Corp.,** Worcester, Mass., compounders of thermoplastic materials.

Fred A. Weymouth appointed VP **Interchemical Corp.,** New York, N. Y. He will be responsible for production, plant, and purchasing.

Dr. I. Heckenbleikner appointed research dir., **Carlisle Chemical Works, Inc.,** Reading, Ohio and its div., **Advance Solvents & Chemical,** New Brunswick, N. J.

Harold G. Shelton, formerly dir. of marketing, appointed gen. mgr. of the **Dyestuff & Chemical Div., General Aniline & Film Corp.** He replaces **Philip M. Dinkins,** elected pres.

Harrison F. Rowbotham joined **B. B. Chemical Co.,** Cambridge, Mass., subsidiary of **United Shoe Machinery Corp.,** as mgr. of their Bostik industrial adhesives dept.

Spencer M. Wright named mgr. of the newly formed **Mechanical Industries Div., Markem Machine Co.,** Keene, N. H. The div. will handle sales and service of the company's marking machines, ink, and type to manufacturers of plastics products, packaging materials, etc.

Robert M. Lawlor named Philadelphia dist. mgr., **Taylor Fibre Co.,** Norristown, Pa. He will be responsible for sales of laminated plastics and vulcanized fibre in the Middle Atlantic States. Taylor has moved its Southern dist. office from 254 East Paces Ferry Rd., N. E., to the H. W. Ivey Bldg., 3272 Peachtree Rd., N. E., Atlanta, Ga.

Milton Podell, formerly VP—sales, elected pres. of **Vantines, Inc.,** Long Island City, N. Y., manufacturer of polyethylene products.

Walter P. Hwozdek named development mgr. **National Polychemicals, Inc.,** Wilmington, Mass.

Mortimer H. Nickerson, previously chief chemist for DeBell & Richardson, Inc., joined **Arthur D. Little, Inc.,** Cambridge, Mass., as a staff associate in the R & D div.

Louis H. Collins appointed plant mgr. of **Flexible Products Co.,** Marietta, Ga.

David C. Hawk has been named mgr.—technical service of **Cary Chemicals, Inc.**

H. H. Pomeroy appointed mgr. of the **Plastics Div., Chemical Process Co.,** Redwood City, Calif.

G. Thomas Parker joined the Midwest office of **Farrel-Birmingham Co., Inc.,** 10725 S. Western Ave., Chicago, Ill., and will assist **G. R. Gonyer,** Midwest mgr., in the sale of plastics machinery.

Arnon L. Lundborg joined the New York office of **Archer-Daniels-Midland Co.,** and will handle sales of Admex vinyl plasticizers.

Philip B. Stull resigned as a VP, dir., and member of the exec. committee of **Hercules Powder Co.**

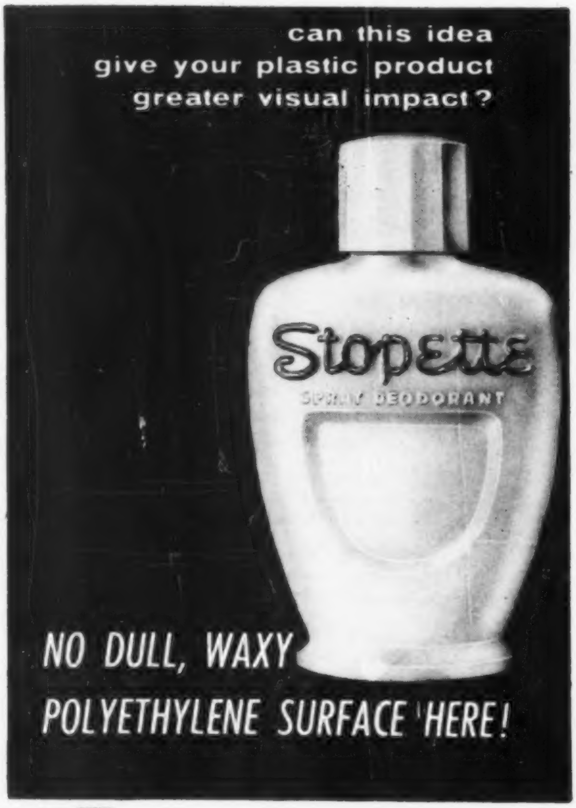
He plans to elect early retirement, but until then will be a special asst. to Hercules pres. **A. E. Forster,** concerned primarily with developing the company's foreign business, particularly in the European Common Market.

Clyde W. Foster appointed to newly created post of Midwest dist. sales mgr., Parts Div. of **Sylvania Electric Products Inc.,** with headquarters at Melrose Park, Ill. This div. manufactures plastics closures, tools, dies, etc.

Corrections

"New approach to drainage" (MPL, Nov. 1958, p. 161): The depth at which the arch-shaped vinyl drains are installed is between two to three feet, according to Charles D. Busch of the United States Dept. of Agriculture, and *not* "only a few inches below the surface" as described in the article.

"Machinery and Equipment." (MPL, Jan. 1959): Caption appearing under photo on p. 130 should run under illustration on p. 132. Caption under the latter belongs with picture on p. 130.—END



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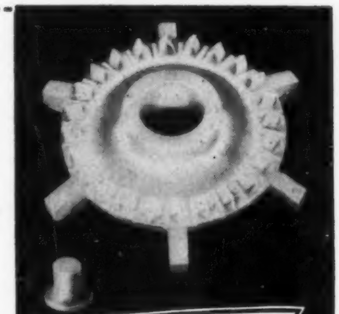

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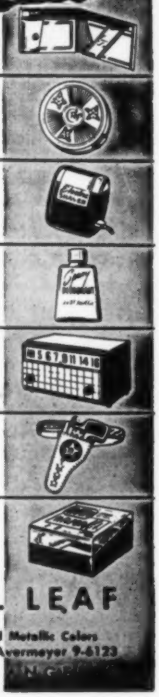

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THE FORUM

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

The Editor, Modern Plastics:

We have read with interest the very comprehensive, two-part article in Modern Plastics by George L. Booth concerning coating methods. The articles are well written, and the clear diagrams are most helpful in understanding the text. Perhaps the most ingenious part of the presentation is the schematic guide which appears with Part 2 in the October issue.

The example which the author has chosen to illustrate use of the guide, namely the application of polyethylene to kraft paper, reminds us that he may have overlooked a relatively new material. We are referring to Eastman's Epolene C polyethylene which is a material that is capable of being applied to paper as a hot melt.

Epolene C is a low-molecular-weight polyethylene and as such is not satisfactorily extrudable. Thus, referring to the example in your guide, the coating is viscous but not extrudable, so it would be necessary to continue vertically down the chart to the next lower box. The comments concerning application of coatings thicker than 1 mil would, in general, be satisfactory for Epolene C. For coatings thinner than 1 mil, either of the two types of application at the bottom of this column should be satisfactory.

We have had very good success with applying Epolene C polyethylene to paper in web form using a laboratory scale coating machine manufactured by Haida Engineering Co. Figure 16 in the article comes nearest to illustrating our current method of application, with the following exceptions: the coating roll rotates in the same direction as the paper web is traveling. A doctor blade is pressed against the coating roll on the left-hand side and angling upward from left to right. The smoothing bar is indeed smooth and not wire wound. The reservoir, coating roll and smoothing bar are all heated by circulating Dowtherm. The three rolls following the smoothing bar are cooled by circulating water. Epolene C polyethylene is applied to paper at a melt temperature of approximately 350° F., at which temperature it has a viscosity in the range of 8000 to 10,000 centipoises. The chill rolls following the smoothing bar cool the coating rapidly and this rapid chill gives us excellent gloss.

R. W. Miller, Chemicals Division, Eastman Chemical Products, Inc., Kingsport, Tenn.

The Editor, Modern Plastics:

The Encyclopedia Issue of Modern Plastics which arrived this morning is, I think, the best one on plastics development I have ever seen.

I was most interested to read what the Encyclopedia has to say with regard to the Ziegler-type of polyethylene in which, as you know, we specialize. I trust you will not mind my mentioning that I feel the remarks on p. 114, center column, are no longer quite fair to the Ziegler-type of polyethylene pipes if, in fact, this is the type of high-density pipe which the author had in mind: "One of the most desirable features of the low-density polyethylene pipe is its flexibility which permits marketing in easily handled coils, whereas the high-density type, owing to its higher stiffness, requires shipment in straight lengths."

You may be interested to hear that by altering some of the features during the extrusion, cooling, and hauling off of the pipes, we have overcome all the difficulties which were originally, I admit, inherent in this type of pipe. Now we can supply all pipe up to 2-in. O.D. in the normal 500-ft. coils, and 2⅜-in. O.D. pipe in 250- or 300-ft. coils. Hardly any of this material, except for a special request by the customer, is being shipped now in straight lengths and there are just as few joints and fittings needed as for the more conventional type of soft polyethylene.

In fairness to your readers I must, however, point out that in making these coils of Ziegler-type polyethylene it is necessary to watch very carefully the cooling gradient and accordingly, the distance between the cooling tank and the coiler. If this distance is either too short or too long the "memory" of the polyethylene pipe makes the coils jump if the string being used during transport is released. The coils of our pipes which we market under the trade name of Deltathene can be opened without danger and laid flat on the ground without any difficulty.

F. M. Pinoff, Director, Copper & Alloys, Ltd., West Bromwich, Staffordshire, England.—END

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FOR SALE: Dreher rotary cutter, large model, complete with 200V, 60 cycle, 3 phase 5½ H.P. motor with necessary drive mounted on integral base. First class condition—Experimentally used only. Polyplastex United, Inc., 870 Springfield Road, Union, N. J.

FOR SALE: 1000 ton and 2000 ton Hydraulic Presses—20 oz. model H-200 Van-Dorn Injection Machine—400-500 ton 36" x 36" Hydraulic Presses—2¾" and 3¼" Plastic Extruders—Carver Laboratory Presses and others—up to 75 ton—6" x 13" Laboratory Mills and Calenders. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J., telephone DE 4-1616—cable address Plasmex-Boonton.

HIGH FREQUENCY HEAT GENERATORS: One Thermex 7 K.W., 19.1 meg's, grid size 14" x 20". One Thermex 15 K.W., 13.7 meg's, grid size 23" x 26". One Thermall 22 K.W., 70 meg's, grid size 41½" x 41½". All units complete and for operation on 220 volt, 60 cycle, 3 phase. Good condition. Standco Supply Co., 2701 Clinton Dr., Houston, Texas.

FOR SALE: Ovens, Grinders, Powder Mixers, Injection Molding Machines 1 oz. to 60 ozs. never used and used, Two-head Bottle Blowing Machine. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass. PLeasant 7-7747, 5222 W. North Ave., Chicago, Ill. TUxedo 9-1328.

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MACHINERY AND EQUIPMENT FOR SALE: 1 Taylor Stiles "Little Giant" No. 710 Dicing Cutter 24 knife steel cylinder @ 2000 R.P.M. 25 H.P. motor 220/440 60C 3P for 9½" wide sheet. Serial #2452. Will slit and cross cut ¼ x ¼ x 0.20. In perfect condition. 2—Robinson Choppers—Size #1624 5-24" Stationary Knives 10-12 Rotating Knives—24" Throat opening. One wothout motor, one with motor—G.E. Tri/Clad induction motor 220/440 V 3P 60C 1760 R.P.M. In good condition. Reply Box 5318, Modern Plastics.

FOR SALE: Baldwin-Southwark 200 ton semi-automatic transfer molding press. 2500 ton downstroke 54" 102". French Oil 250 ton 38"x28". 200 ton hobbing press. 200 ton 16" record presses. D & B 140 ton 36"x36". French Oil 120 ton self-contained. W. S. 120 ton 24"x24". Hydraulic pumps and accumulators. New ¾ oz. Bench Model Injection Machine. Reed 22 oz. Injection Machine. Hartig 3¼" Plastic Extruder. MPM 2" Plastic Extruder. Adamson 6" rubber extruder. Oil and Elect. Plastic extruders, lab to 6". Van Dorn 1 and 2 ounce injection machines. Lester 16 oz. complete. Other sizes to 100 oz. Baker-Perkins and Day jacketed mixers. Plastic cutters. Oxford 57" slitter. Seco 6"x13" and 8"x16" mills and calenders. Single & Rotary preform press ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Co., 107—8th St., Brooklyn 15, N.Y.

PRICED VERY LOW BEFORE MOVING: 22 oz. Reed-Prentice Inj. Molding Press, 1946, 600 ton, complete. $7950. Also available: 48 Oz. H.P.M., 1955; 4 Oz., 8 Oz. Machines. Raco Industrial Corp., 1096 Merchandise Mart, Chicago, WH-4-1334.

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INJECTION MACHINE & MOLDS: 6 oz. Reed Prentice Injection Molder with 25 H.P.-A C Motor and controls. Worker order $2500; 10½" & 16", 2 cavs, 3½" diam. and 1" meter covers, $100; 13½" and 17", 8 cavs, 4 bottles 2" and 2" w/½" covers, $100; 13½" and 20", 12" cavs, 2½" diam. and ⅛" thick, industrial, $100; 14" and 18", 4 cav dividers 4" and 5", used for razor blades display, $200. F.O.B., Bklyn. All models open for inspection. Equipment Liquidating Co., 415—3rd Ave., Bklyn 15, N.Y.

FOR SALE: 4 compression molding presses, 300, 200, 100 and 50 tons; 1 Read 25 gallon stainless double arm mixer; 1—18" x 50" Thropp plastics mill, M. D.; 1 Ball & Jewell #½-TD granulator, 15 HP; 3 Strokes preform machines, R, RD-3, DS-3; also extruders, presses, etc. Chemical & Process Machinery Corp., 52 9th St., Brooklyn 15, N.Y., HY 9-7200.

FOR SALE: H.P.M. Rubber Injection molders, 21½"x28" mold space, steam heated platens. Watson-Stillman 300 ton semi-automatic compression molding press (1947) self-contained mold size 34"x27". Watson-Stillman 250 ton 28"x24". Watson-Stillman 140 ton 22"x16". Waterbury Farrel 85 ton 20"x24". W.F. 63 ton 15"x15". Laboratory presses—15 ton 10"x 8" and 10 ton 6"x6" platens. (2) 8 ounce Reed Prentice injection molding machines and (1) 8 ounce Lester Phoenix (late) with nylon attachment. Scrap cutters, valves, accumulators. Hydraulic Presses—all sizes. Aaron Machinery Co. Inc., 45 Crosby St., New York, N.Y. Tel.: WAlker 5-8300.

FOR SALE: One Model Reed Prentice 8 oz. Double Toggle—Welded Frame—rebuilt 1958. One Model Reed 24 oz. One Model Watson 22 oz. 480 Ton Clamp 30 inch Daylight. Including extra 12 oz. High Pressure Cylinder. All machines include instruments. All machines in operation. American Molded Products Company, 2727 W. Chicago Avenue, Chicago 22, Illinois.

FOR SALE: 5—Thropp 20"x22"x60" two roll Mills with Falk reducers and 125 HP motors; 5—Baker Perkins size 15 JIM2, 100 gal. steam jacketed double arm Mixers; 1—Baker Perkins size 16 TRM, 150 gal. double arm Mixer; 1—Ball & Jewell #1 Rotary Cutter; 1—Kent 6"x14" three roll Mill; 6—Stokes Model DD2, DS3, D3 and B2 Rotary Preform Presses; 4—Stokes Model "R" single punch Preform Presses. Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N.Y.

FOR SALE: World's Largest Stock of Double Arm Mixers—43—Baker-Perkins #17, 200 gal. jacketed sigma blade Mixers. Some units with individual 30 HP motors, drives and screw tilts. Others with counter-weight tilts. Prices are cheaper than ever before—They All Must Go. Phone or wire for details. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

Machinery wanted

WANTED TO BUY: Good used NRM 1" extruder; 1¼" or 1½" extruder of other manufacture would also be satisfactory. Give details of dies available or take-off equipment. Send reply to Acheson Dispersed Pigments Co., 2250 E. Ontario Street, Philadelphia 34, Pa., attention of W. F. Polfus.

WANTED: Used 8 to 12 opening Steam heated and Water Cooled Hydraulic Laminating Press. Platens sized 24" to 36" in width and 70" to 85" in length. Reply Box 5321, Modern Plastics.

WANTED: Transfer (Plunger) Molding Press, 50 to 150 ton capacity, with semi-automatic controls and Hydraulic Power Unit. Must be in good condition and complete. Also want small Electronic Pre-heater, approximately one pound per minute. Include full particulars. Reply Box 5300, Modern Plastics.

PRESSES WANTED: Stokes Type # E, F-4, T-4; Colton Type # 3DT. Send full particulars and price to Mansol Ceramics Company, 140 Little St., Belleville, N.J.

WANTED: Six or eight inch Plastic Extruder, electrically heated with or without vari-drive. Give complete specifications, price and where it can be inspected. Reply Box 5301, Modern Plastics.

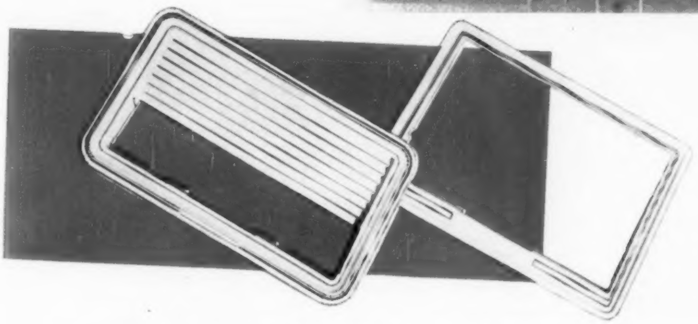
WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass., PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

(Continued on page 222)

WINDSOR

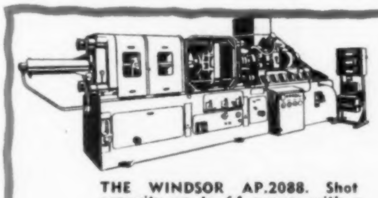
-the word for Faster Output

For large size mouldings, such as radio and television cabinets, which must maintain a high standard of perfection, there are Windsor pre-plasticising models which greatly speed-up output without sacrificing anything in quality and precision.

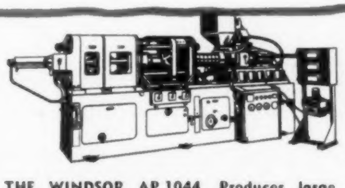


The radio cabinet shown in the top illustration, and the front mouldings above, are of Polystyrene produced on a Windsor AP. 2088 fitted with pre-plasticising unit.

Designed with streamlined compactness and built with fine precision these Windsor pre-plasticising injection moulding machines are particularly suitable for filling deep units of large areas. Both models bear the hall-mark of excellence which has placed Windsor first and foremost in the field of plastics engineering.



THE WINDSOR AP.2088. Shot capacity up to 64 ounces with a moulding area of 300 square inches.



THE WINDSOR AP.1044. Produces large mouldings up to 32 ounces per shot with a moulding area of 160 square inches.

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Head Office: LEATHERHEAD ROAD, CHESSINGTON, SURREY, ENGLAND London Office: 76 JERMYN ST., ST. JAMES'S, LONDON, S.W.1., ENGLAND

(*Continued from page 220*)

Materials for sale

REPROCESSED NYLON FOR SALE: Reprocessor offers highest quality pelletized nylon in all common resin types. Natural and black available from stock. Custom colors compounded on request. Samples and quotations promptly furnished. Adell Plastics Inc., 5208 Eleanora Avenue, Baltimore 15, Md.

Materials wanted

PLASTIC SCRAP: All types and grades purchased, large and small quantities. Top prices. Send description, and small representative sample to: Success Plastics Corporation, P. O. Box 506, Indianapolis, Indiana. LIberty 6-2919.

WANTED: Plastic scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 514 West 24th Street, New York 11, N. Y.

WANTED: Plastic of all kinds—virgin, reground, lumps, sheet and reject parts. Highest prices paid for Styrene, Polyethylene, Acetate, Nylon, Vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y. RAvenswood 1-0880.

WANTED: Vinyl and Polyethylene Scrap. Send description and small sample. We are continuous buyers. American Vinyl Corp., 73-30 Grand Ave., Maspeth 78, N.Y. Tel: DEfender 5-9200.

WANTED: All types of plastic scrap and surplus inventories such as: styrenes, butyrates; acetates, acrylics and polyethylenes in any form. Write, Wire or Phone Collect, Humboldt 1811. Philip Shuman & Sons, 15-33 Goethe Street, Buffalo 6, New York.

NYLON SCRAP WANTED: by reprocessor. All kinds including molding, extrusion and fabricating. Quotations promptly furnished on all grades and polymer types. Adell Plastics, Inc., 5208 Eleanora, Ave., Baltimore 15, Md.

Molds for sale

MOLDS FOR SALE: Injection molds for commercial fishing floats, size 3 x 5 eight cavity to mold bodies, eight cavity mold for center insert for location and cementing, also two cavity 2-½ x 3-½ size plus clamping fixtures. Molds are almost new, only try-out run has been made. Samples available. American Mold Company, 11285 E. Nine Mile Rd., Warren, Michigan.

FOR SALE: Complete set of injection molds for new, unique and popular priced Record Holder (45 rpm). Single cavity base mold. Double cavity side mold. Perfect condition, practically new. For more information, contact S. Berlin, The Malls Co., 3031 James St., Baltimore 30, Maryland.

Molds wanted

WANTED: Injection Molds in good used condition for 2, 4 and 8 oz. machines, for export. Round Beads 5mm to 16mm. Poppit Beads 10mm and 12mm. Novelty Beads and ornaments for jewelry. Hair ornaments all types including pony tails. Very small toys requiring assembling. Send samples and details to: Debra, Inc., 136 Liberty St., N.Y.C. 6

WANTED: For Export: Compression Molds for tableware, rent or sale, for 150 ton press. Injection Molds—buttons or allied trade for 2 and 4 oz. machines. Items or ideas utilizing a 12-opening, 600 ton laminating press with platen area 20"x24". Send samples and information to: Debra, Inc., 136 Liberty St., N.Y.C. 6

Help wanted

INJECTION MOLDING SUPERINTENDENT: Leading Southern California plastics Company offers excellent opportunity for young man with at least five years supervisory experience in injection molding to take charge of our injection molding production. Must have thorough technical knowledge of plastic materials and tooling. Should have personality and ability to grow with the Company. Send resume to Box 5316, Modern Plastics.

ASST. TO SALES MANAGER: Young aggressive man with knowledge of reinforced plastic laminating techniques wanted to assist sales manager of prepreg materials. Duties will involve sales, technical service and contact with distributors. Eastern location involving some travel. Excellent opportunity in progressive company. Naturally, all confidences will be respected. Please send complete resume. Reply Box 5319, Modern Plastics.

PLASTICS ENGINEERS: Technical graduate, preferably ME, experienced in plastics applications related to resin testing and evaluation, extrusion, injection molding and machine design for R & D assignments in expanding plastics group with Nylon-6 project. Challenging opportunity, complete benefit plans. Excellent working conditions. National Aniline Division, Allied Chemical Corporation, Hopewell, Virginia.

WANTED PLANT SUPERINTENDENT: Must be experienced in injection molding. High type individual. Exceptionally good future. Salary open for right man. Write—A. C. Martinelli, Rogers Plastic Corporation, West Warren, Massachusetts.

WANTED: Young Man for Sales. To sell plastic closures and metal containers in the New York metropolitan area for old established firm. Excellent opportunity. No experience necessary since we will train you. College graduate preferred. Salary open. Send resumes on experience and education. Replies will be confidential. Reply Box 5302, Modern Plastics.

HELP WANTED: We are a large machinery building company catering to the textile and leather industries. Within the past four years we have been manufacturing equipment on special order for the plastics industry. Now we would like to expand on a national basis producing a complete line of extruders and auxiliary equipment for extruders. We are looking for people in sales, engineering, and any others who can help us develop a long term program in the plastics field. All replies will be kept confidential. Reply Box 5309, Modern Plastics.

PLASTIC MATERIAL SALESMEN WANTED: Plastic material salesmen for polypropylene sales, with degree in Chemical, Mechanical or Industrial Engineering. Background in plastics essential. Willingness to relocate and travel by car important. All replies confidential. Send resume to Box 5322, Modern Plastics.

PLASTICS DEVELOPMENT: Technical man experienced in plastics extrusion, injection molding, blow molding. Familiarity with various plastics and equipment necessary for development of new products and replacement of present products. Plant located in Southern New England. Reply Box 5323, Modern Plastics.

EXTRUSION MANAGER: Excellent position for experienced man to supervise sheet production for vacuum former. Wonderful opportunity for growth with long established expanding company. Good salary plus bonus. Reply in confidence stating details and salary required. Reply Box 5353, Modern Plastics.

EXPANSION CREATES OPENINGS FOR EXPERIENCED PLASTICS ENGINEER: As a major manufacturer of electronic and electro-mechanical devices, we are planning considerable acceleration of our activities in plastics compounding on a laboratory, pilot production and production basis. If you have a bachelor's degree, or preferably an advanced degree, in Chemistry or Chemical Engineering, and can point to a satisfactory experience record, you will find much to interest you here. This is a critical, responsible position which requires a minimum of 5 years experience, a portion of which, at least, should include activity in plastic compounding. Your record should denote a broad interest that ranges from the research aspect to production supervision and control. Basically, your background should qualify you to help us obtain specific material characteristics which are not ordinarily available through commercial sources and to maintain highly exacting controlls on material characteristics. Salary commensurate with ability. Relocation expenses paid. Numerour company benefits. Plant is adjacent to fine, new residential area in Kansas City, Missouri. Numerous modern, highly-rated schools. Favorable climate, many cultural and recreational facilities contribute to pleasant living. Company offers assistance program for engineers who desire advanced study at local universities. Airmail brief resume at once to Mr. T. H. Tillman, Bendix Aviation Corp., Box 303-EZ, Kansas City, Missouri.

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 220 South State, Chicago 4, Ill—Wabash 2-4800. Call, write or wire—in confidence.

WANTED: Custom extrusion plant manager for Midwest. Special rigid shape knowledge required. Reply Box 5320, Modern Plastics.

MARKET DEVELOPMENT: Opportunity to join Spencer Chemical Company's expanding Plastics Market Development program in a position which will permit the use of sales and technical abilities. We are seeking men who have a chemical or engineering background, and preferably three to five years' experience with thermo-plastics. A working knowledge of polyethylene and nylon is desirable but not essential. A unique opportunity exists to work with a new thermo-plastic—polypropylene. Please send detailed resume to: W. H. Swope, Personnel Manager, Spencer Chemical Company, 610 Dwight Building, Kansas City 5, Missouri

WANTED: Engineer experienced in compounding and extruding rigid PVC—capable of organizing extrusion group for company not presently in this field. Responsibilities include equipment selection, die design, and formulating. Compensation commensurate with ability. Must be willing to locate in Northeastern Ohio. Reply giving age, experience, and other qualifications. Applications carefully considered and kept strictly confidential. Reply Box 5314, Modern Plastics.

PLASTIC SHEET PRODUCTION ENGINEER: Minimum starting salary of $10,500 for energetic man completely experienced in setting up, training personnel and running plastic sheet department to produce quality high impact styrene sheet. Should be completely experienced in vacuum forming and die cutting operations. This is a key man position. Employee benefits. Bonus arrangement and stock ownership opportunities. Plant location—Florida. In reply, state past background and experience. All replies held confidential. Reply Box 5307, Modern Plastics.

(*Continued on page 224*)

(*Continued from page 222*)

Situations wanted

PIPE AND FILM EXTRUSION: Working administrator with heavy practical and mechanical engineering experience. All phases of production and maintenance, including ability to personally perform precision work in machine shop. Strong background in training help. A supervisor of production and personnel who offers experience, integrity and drive to progressive employer. Reply Box 5312, Modern Plastics.

MANAGEMENT ENGINEER with 11 yrs. solid shirtsleeve mfg. experience & expert knowledge of color compounding polyethylene, polypropylene & use of Banburys, extruders, roll mills. Also worked with reprocessing film, camel back & other types of scrap polyethylene, Styrene & vinyl plastics. Adept at problem anaylsis & cost reduction. B.S. Chem. Eng. + Bus. Adm. $12,000 min. Age 34. Reply Box 5310, Modern Plastics.

REINFORCED PLASTICS CONSULTANT: MIT Graduate in Chemical Engineering, Business and Engineering Administration. Experienced in all phases of reinforced plastics. Specialist in reinforced polyester molding compounds. Excellent background in new product development, technical sales and trouble-shooting production problems. Reginald B. Stoops, 445 Park Avenue, New York 22, N. Y. Tel.: MUrrayhill 8-3800.

RARE TEAM: Recognized Chem. Engr.—Proven Creative Salesman. Two 33 yr. old executives with a successful achievement record as New Product Developers and Top Sales Producers. Sound knowledge current technology, equipment design, process engineering, industrial marketing. Excellent reputations and contacts in many phases of plastics. Reply Box 5317, Modern Plastics.

SALES ENGINEERING: Graduate Mechanical Engineer, 34, eight years experience in Sales and Plant Engineering for large companies in Plastics and Rubber industries, seeking sales opportunity. Reply Box 5308, Modern Plastics.

40 YEARS PLASTIC EXPERIENCE: 3 Man Management, Production and Engineering Team. Will operate any size molding plant at top margin. Can use existing facilities or set up new operation innumerable sales leads, appliance, automotive & custom. Want share of business plus salary. Reply Box 5311, Modern Plastics.

Business opportunities

RIGHTS AVAILABLE on royalty basis to Plastic or Advertising Manufacturer for the Squirter Diverter. Squirter Diverter fits a standard beer can opener and prevents the "Squirt." Can be printed. A must for every beer can opener. Des Moines Design & Engineering Co., 1218 Grand Ave., Des Moines, Iowa.

AUSTRALIAN PLASTICS COMPANY interested in acquiring licence rights to manufacture patented plastic articles or developing plastic processes. All enquiries to P.O. Box 68, North Sydney, N.S.W., Australia.

OPPORTUNITY IN EUROPEAN COMMON MARKET: Big Italian corporation manufacturing electrical, automotive and plastics products is interested in acquiring for manufacture in Italy new processes, patents, know-how, and products in the electrical, chemical, pharmaceutical and plastics fields. Reply Box 5306, Modern Plastics.

DEVELOPMENT DEPARTMENT of International Company of Plastic Applications, Nyon (Switzerland) offers to study and make necessary survey merchandising possibilities of new inventions or processes, at no cost. Interesting propositions could possibly be financed and exploited. If interested, mail all particulars to: CIDAP, NYON (Switzerland).

WANTED: Will purchase—going business of plastic Proprietary Items—Molds and Accounts, Factory and Machines not absolutely necessary but will accept Complete—Reply in confidence. Reply Box 5304, Modern Plastics.

Miscellaneous

FOR LEASE: Concrete building containing approximately 14,000 square feet of floor space, situated on 100 acres and two U. S. Highways, with railroad siding. Reply Box 5313, Modern Plasitcs.

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For further information address Classified Advertising Department Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

Modern Plastics reserves the right to accept, reject or censor classified copy.

INDEX OF ADVERTISERS

Distribution of this issue: 33,600 **February 1959**

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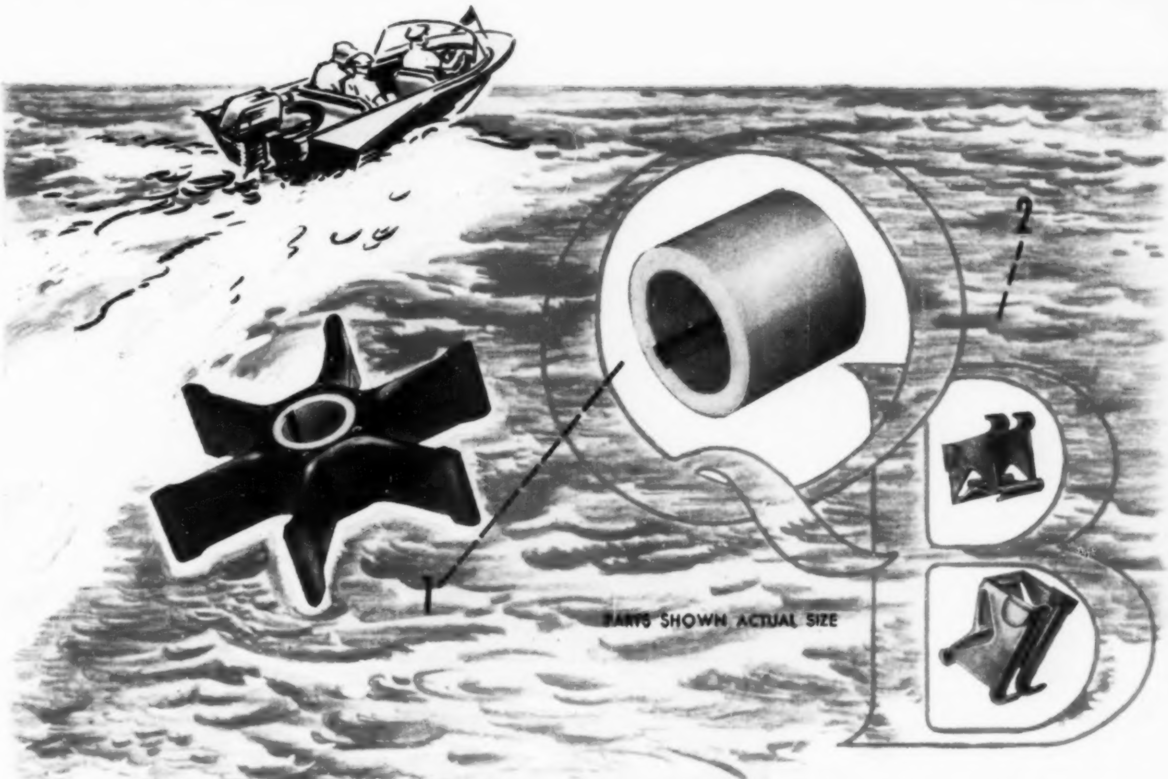

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They're by Quinn-Berry, of course!

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Here are two good examples of Quinn-Berry contributions to the improvement of end products.

1 At the left above is the Quinn-Berry molded nylon pump impeller insert used in Evinrude's 50 hp. Starflite motor. The dimensional stability of molded nylon affords tough resistance to thrust and shear stresses at all temperatures . . . and nylon is unaffected by salt water. It will not corrode.

2 Evinrude uses the molded nylon combination bearing and detent spring (above right) in the 10 hp. and 18 hp. motors to control the position of the choke. This Quinn-Berry molded part requires a minimum of lubrication, has excellent wearing characteristics and salt water will not corrode it.

Consult with us on your component parts design and material requirements. Quinn-Berry molded thermoplastics are doing a good job in a wide diversity of applications.

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QUINN-BERRY CORP.

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CUSTOM MOLDERS OF ALL TYPES OF THERMOPLASTICS

(*Continued from page 226*)

MODERN PLASTICS

A BRESKIN PUBLICATION

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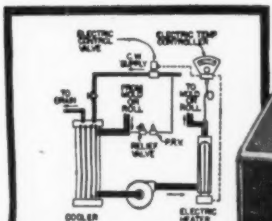

▲ Schematic diagram of control circuit in the Sarcotrol Model MC-1, Single Unit. Model MC-2, Dual Unit, is equipped with two of these circuits. Model MC-3 has three complete circuits.

Sarcotrol Model MC-2 Heating and Cooling Unit for injection molds, cylinders, rolls and drums. Fully enclosed. Easily seen, completely accessible control knobs. ▶

With Sarcotrol Automatic Temperature Control a dial setting gives you *quality control*, and helps to free your production from the problems of *sticking, shrinkage* and *crazing*.

Sarcotrol helps you step up output, and cut down rejects. New, higher cooling capacity makes the Sarcotrol suitable for calender rolls and large molds.

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1. Single knob adjustment of simple, selective control
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Reprints of articles, features and news items that appear in Modern Plastics are often surprisingly inexpensive when ordered in quantity. Many companies make it a practice to have stories which have a bearing on their business reprinted for distribution to their personnel, customers, prospects, stockholders or to other interested groups.

Whenever you see editorial matter of this type in Modern Plastics magazine or the Encyclopedia issue which you can use in reprint form, in quantities of 200 copies or more, write and quotations will be furnished promptly.

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EDITORIAL

Alphabetic abbreviation for plastics and resins

If the vitamin industry had not turned to alphabetic abbreviations two decades ago, it is doubtful whether public acceptance and understanding of vitamin products would have been so rapid and sales so vigorous.

Plastics have names that are quite as resonantly complicated as those of the vitamins, and the necessity for some sort of simplification and abbreviation has long been recognized.

Committee D-20 of ASTM has presented to the parent society, and has received acceptance of, a list of alphabetic abbreviations of terms relating to plastics and resins as well as of plastic and resin additives. Here are the plastics and resins and their abbreviations established to date:

Acrylonitrile-butadiene-styrene plastics	ABS
Carboxymethyl cellulose	CMC
Cellulose acetate	CA
Cellulose acetate butyrate	CAB
Cellulose nitrate	CN
Diallyl phthalate plastic or resin	DAP
Ethyl cellulose	EC
Melamine-formaldehyde	MF
Phenol-formaldehyde	PF
Poly (acrylic acid)	PAA
Polyacrylonitrile	PAN
Polyamides (synthetic)	Nylon
Polybutadiene-acrylonitrile	PBAN
Polybutadiene-styrene	PBS
Polychloroprene	PC
Polyethylene	PE
Poly (hexamethylene adipamide)	Nylon 66
Polyisobutylene	PIB
Polyisobutylene-isoprene	PIBI
Poly (methyl-α-chloroacrylate)	PMCA
Poly (methyl methacrylate)	PMMA
Polymonochlorotrifluoroethylene	PCTFE
Polystyrene	PS
Polytetrafluoroethylene	PTFE
Poly (vinyl acetate)	PVAc
Poly (vinyl alcohol)	PVA
Poly (vinyl butyral)	PVB
Poly (vinyl chloride)	PVC
Poly (vinyl chloride-acetate)	PVCAc
Poly (vinyl formal)	PVF
Urea-formaldehyde	UF

Now that such a good start has been made, the process can be expected to make for further standard abbreviations as the need arises. For example, polyester resin might be abbreviated to PY; reinforced plastics could (and, we think, should) be abbreviated to RP.

Whenever these abbreviations are used in publications, their first occurrence in text should be enclosed in parentheses and preceded by the written word or words being abbreviated. Subsequent references to the plastics in the article can then be by the appropriate abbreviation only.